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ABSTRACT

This document presents the design, overview and general findings from the case study project funded by the National Science Foundation to gather data about science, mathematics and social science education in American schools. The case studies themselves, which constitute chapters 1 through 11 of this report, are contained in a separate volume. Chapters 12 through 19 are entitled: (1) The Various Aims of Science Education; (2) The K-12 Curriculum; (3) Pluralism and Uniformity; (4) Student Learning; (5) The Teacher in the Classroom; (6) The School and The Community; (7) Survey Findings and Corraborations; and (8) Knowing and Responding to the Needs of Science Education. (PEB)

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SE-78-74

Case Studies in Science Education

Volume II
DESIGN, OVERVIEW and GENERAL FINDINGS

Prepared for:
National Science Foundation
Directorate for Science Education
Office of Program Integration

SE 026 708

This document is one of seven as listed below. They are reports of three complementary studies of the status of pre-college science, mathematics, and social science education.

26,360

1. The Status of Pre-College Science, Mathematics, and Social Studies Educational Practices in U. S. Schools: An Overview and Summaries of Three Studies SE 78-71
Stanley L. Helgeson, Robert E. Stake, Iris R. Weiss, et al.
Ohio State University, University of Illinois, and Research Triangle Institute

2. Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education SE 78-72
Iris R. Weiss
Research Triangle Institute

3. The Status of Pre-College Science, Mathematics, and Social Science Education: 1955 - 1975
Volume 1: Science Education SE 78-73 Vol. I
Stanley L. Helgeson, Patricia E. Blosser, and Robert W. Howe
Center for Science and Mathematics Education, the Ohio State University

4. The Status of Pre-College Science, Mathematics, and Social Science Education: 1955 - 1975
VolumeII: Mathematics Education SE 78-73 Vol. II
Marilyn N. Suydam and Alan Osborne
Center for Science and Mathematics Education, The Ohio State University

5. The Status of Pre-College Science, Mathematics, and Social Science Education: 1955 - 1975
VolumeIII Social Science Education SE 78-73 Vol. III
Karen B. Wiley with Jeanne Rice
Social Science Education Consortium, Inc.

6. Case Studies in Science Education
Volume I: The Case Reports SE 78-74 Vol. I
Robert E. Stake, Jack Easley, et al.
Center for Instructional Research and Curriculum Evaluation, University of Illinois

7. Case Studies in Science Education
Volume II: Design, Overview and General Findings SE 78-74 Vol. II
Robert E. Stake, Jack Easley, et al.
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CASE STUDIES IN SCIENCE EDUCATION

Volume II

Design, Overview
and
General Findings

Chapters A, B, C, and 12-19

Center for Instructional Research and Curriculum Evaluation
and
Committee on Culture and Cognition
270 Education Building
University of Illinois at Urbana-Champaign

January 1978

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The Project

Case Studies in Science Education is a collection of field observations of science teaching and learning in American public schools during the school year 1976-77. The study was undertaken to provide the National Science Foundation with a portrayal of current conditions in K-12 science classrooms to help make the foundation's programs of support for science education consistent with national needs. It was organized by a team of educational researchers at the University of Illinois.

Eleven high schools and their feeder schools were selected to provide a diverse and balanced group of sites: rural and urban; east, west, north and south; racially diverse; economically well-off and impoverished; constructing schools and closing schools; innovative and traditional. They were finally selected so that a researcher with ample relevant field experience could be placed at each. To confirm findings of the ethnographic case studies and to add special information, a national stratified-random-sample of about 4000 teachers, principals, curriculum supervisors, superintendents, parents, and senior class students were surveyed. Survey questions were based on observations at the eleven case-study sites.

The field researchers were instructed to find out what was happening, what was felt important, in science (including mathematics and social science) programs. On site from 4 to 15 weeks they were not required to coordinate their work with observers at other sites. Questions originally indicated important by the NSF or identified early in the field were "networked" by the Illinois team. Efforts to triangulate findings were assisted by reports of site visit teams.

Each observer prepared a case study report which was preserved intact as part of the final collection, and later augmented with cross-site conclusions by the Illinois team. The cost of the study was just under $300,000, taking 18 months actual time and about 6 research-person years to complete.

In the principal findings it was noted that each place was different in important ways, that each teacher made unique contributions. Nationally we found that science education was being given low priority, yielding to increasing emphasis on basic skills (reading and computation). Still, the CSSE-high-school science faculties worked hard to protect courses for the college-bound, with many of these courses kept small by prerequisites and "tough" grading. Only occasional efforts were made to do more than "read about" science topics in most of the elementary schools. Although ninth-grade biology and eighth-grade general science flourished, general education aims for science instruction were not felt vital at any level. Seldom was science taught as scientific inquiry--all three subjects were presented as what experts had found to be true. School people and parents were supportive of what was chosen to be taught, complaining occasionally that it was not taught well enough. The textbook usually was seen as the authority on knowledge and the guide to learning. The teacher was seen to be the authority on both social and academic decorum. He or she worked hard to prepare youngsters for tests, subsequent instruction, and the value-orientations of adult life. Though relatively free to depart from district syllabus or community expectation, the teacher seldom exercised either freedom.

Each of the above statements is only partly correct. This summary is a drastic oversimplification of the circumstances observed by the field people and portrayed in the case study reports. The picture at each of the sites--seen through the experienced but singular eyes of our observer--is a special picture, greatly influenced by the administrators, the parents, and the students encountered; colored with technical, professional, economic and social problems. Somehow the pictures do not aggregate across sites to be either the picture of national education represented by the popular press (though no less aggrieved) or that presented in the professional education publication (though no less complicated). It is an interesting collection.

Robert E. Stake
Jack A. Easley, Jr.
Codirectors

LIST OF CASE STUDY SITES

	Code Name	Description	Field Observer
1	RIVER ACRES	a suburb of Houston	Terry Denny
2	FALL RIVER	a small city in Colorado	Mary Lee Smith
3	ALTE	a suburb of a large Midwestern city	Louis M. Smith
4	BRT	a consolidated district in rural Illinois	Alan Peshkin
5	URBANVILLE	a metropolitan community of the Pacific Northwest	Wayne W. Welch
6	PINE CITY	a rural community in Alabama	Rob Walker
7	WESTERN CITY	a small city in middle California	Rodolfo G. Serrano
8	COLUMBUS	the Columbus, Ohio, school district	James R. Sanders & Daniel L. Stufflebeam
9	ARCHIPOLIS	an Eastern middle seaboard city	Jacquetta Hill-Burnett
10	VORTEX	a small city in Pennsylvania	Gordon Hoke
11	GREATER BOSTON	an urban section in metropolitan Boston	Rob Walker

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CASE STUDIES IN SCIENCE EDUCATION--ROSTER

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Chapter A

OVERVIEW

There is no Chapter A. Time ran out. In order to get the final report to the NSF on schedule--at the time the review panel was scheduled to review it, early enough so that it might still be distributed to science educators during the 1977-78 school year--we have submitted it without the Overview.

The Overview would have told how we got involved in this project, how a few of us in CIRCE with colleagues from the University of East Anglia and elsewhere had been trying to improve the portrayal of educational programs as a part of curriculum evaluation studies; had been trying to capitalize more on the fact that professional educators and other practitioners of the modern world make so many of their decisions on the basis of conviction and experience, pressed by the irrationalities of social, political and economic affairs; and had been trying to build upon the hermeneutic and verstehen epistemologies for arriving at an understanding (if not an explanation) of the mechanisms of teaching and learning.

At the same time, a few of us on the University of Illinois Committee on Culture and Cognition were becoming increasingly sensitive to the role of context, (or culture, or circumstance, or fifth-order interactions) in shaping youngsters' personal meanings and understandings of science, mathematics and other subject matters. We were impressed with the work of Jean Piaget; found ways of making phenomenological extensions of his ideas as they pertained to educational problems; and were distressed by the increasing belief, partly based (falsely) on his writing, that education should be structured to speed the hierarchical stages of cognitive experience.

Separately, in the fall of 1975, we were delighted to learn about the National Science Foundation's Request for Proposals asking for 10-15 case studies of science teaching and learning to provide information on the present status of things. This was seen to be needed as part of the needs assessment of precollege science education in America to permit staff personnel to plan further the NSF's programmatic support efforts to the schools.

Our plan faced stiff competition. Ours was a unique plan, in fact risky. Most of the plans submitted followed the RFP more closely, relying on a strong sampling plan to enable the small number of sites to represent science classrooms in the country and relying on formal instruments of interviewing and testing and brief site visits to get the case study data. Our plan relied on a weak sampling plan, choosing some of the sites to allow us to put a first-rate field researcher on site for a much longer period of time, following more of an ethnographic or anthropological style. Qualified, experienced field researchers, we realized, would insist on doing the studies their own ways, rather than work from a uniform methodological and conceptual plan, but we decided that such would be a strength as well as disadvantage, relying on successful past efforts, showing the diversity of the American scene in the same sense of diversity that it is seen by the many different people interested in and concerned about education.

Our sites were to be chosen then partly to fit our research manpower, but we were able to give assurance that we would provide a balance of school clusters that would fulfill some of the purposes for which a strong sampling plan is employed. To further counterbalance our weak sampling plan for the selection of sites we propose to conduct a small national sample to attempt to get confirmation of major findings from the case studies.

Our plan was to describe what we found in a way that would be useful to any other person who could not be there to visit for himself. We were not impressed with our ability to see what others could not, but with our opportunity to be where they could not. And to be cautious and redundant, asking again, looking again, seeing cause and consequence, one way and many ways and describing those several things we saw. We were pleased with how Emile Zola once expressed what we considered out obligation:

> *We no longer describe for the sake of describing, from a caprice and a pleasure of rhetoricians. We consider that man cannot be separated from his surroundings, that he is completed by his clothes, his house, his city, and his country; and hence we shall not note a single phenomenon of his brain and heart without looking for the causes or the consequence in his surroundings . . . I should define description: "An account of environment which determines and completes man." . . . In a novel, in a study of humanity, I blame all description which is not according to that definition.*

All this we would have told about in the Overview.

We were able to win that competition because of the strength of the personnel commitment and in spite of the objections to our lack of prespecification of instruments and issues. Our selection of issues, as would be expected, was to wait, more than most other researchers would wait, until we were well acquainted with the conditions in the field. We slowly put together our list of research questions, concentrating on "emic" issues, paying most attention to the perceptions of teachers, other education people, students and parents there in the ten (and later eleven) clusters of schools.

There were four main groups of people working on the project, the field observers (who wrote the case studies), and site visitors (who spent perhaps 3 days at a site), the issue analysts (who coordinated work across the sites and wrote the assimilation chapters), and the survey researchers. The roster is shown after the title page. As is usually the case we had very many different motives for doing this project. One of the few we all agreed on was that we wanted to show that a multiple case study project could be comprehensive, timely, and useful.

We continually had the problem of dealing with our own predilections. We recognized that we were prejudiced in various ways, such as against letting test scores and other social indicators represent the conditions of a child's mind or a teacher's emphasis or preparation. At the outset we thought generally that inquiry teaching is a superior way of getting children learning about science. Also, that teachers crave better books and materials, that specifying school objectives reduces curriculum to a lowest common denominator, and that culture and circumstance influence teaching and learning to a great extent. We of course found widespread support for most of these views. We deliberately sought counter evidence. We tried to increase the range of people who would influence the choice of what would be observed, and how it would be interpreted. But some of our earliest critics confirmed our fears that we did not adequately constrain our biases.

The bias is more apparent in the assimilation chapters than in the case studies. We chose field observers with a range of views about science education, some we knew to be dissimilar from ours. They had their biases, but being experienced and respected in their work, used the methodological purges of their disciplines and wrote (as best they could) balanced and unclouded accounts of teaching at their sites.

The platform for this project was the eleven case studies. They provided for us and our readers many views of the complexity and particularity of each science classroom. It would be unfortunate if the assimilation chapters encouraged readers to dismiss the importance of particular persons or particular contexts. The assimilation chapters should add to the understandings of the case studies, rather than substitute for them. They introduce new data as well as interpretations of old data. We wanted the reader to summarize all these things for himself or herself. We resisted even the idea of providing an executive summary, but our sponsors insisted. Still, we urge our readers not to be satisfied with the press release or the executive summary, or even the assimilation chapters, but to read at least some of the case study reports.

We realized rather early that one of the largest problems would be the coordination of findings from the several sites. We had seen similar projects undertaken by the Center for New Schools and by the Educational Testing Service encountering major time delays and synthesis difficulties because the secondary analysis problems were so great. We decided to rely on a highly informal naturalistic communication system, involving enough curious and compatible people to cover the many happenings but few enough to permit everyone to talk to every one else. That worked out congenially enough but not productively enough. We did not get enough of an exchange about information and issues at the different sites so that field workers could search out possible developments along lines being productively probed elsewhere. After the case studies were completed we spent six months of soaking things up without a satisfactory merging of findings, leaving too much of the essential assimilation for a hectic six weeks prior to the submission of the final report. We did not learn how such a project might be properly organized to handle the synthesis and assimilation of findings from a group of individual case study researchers.

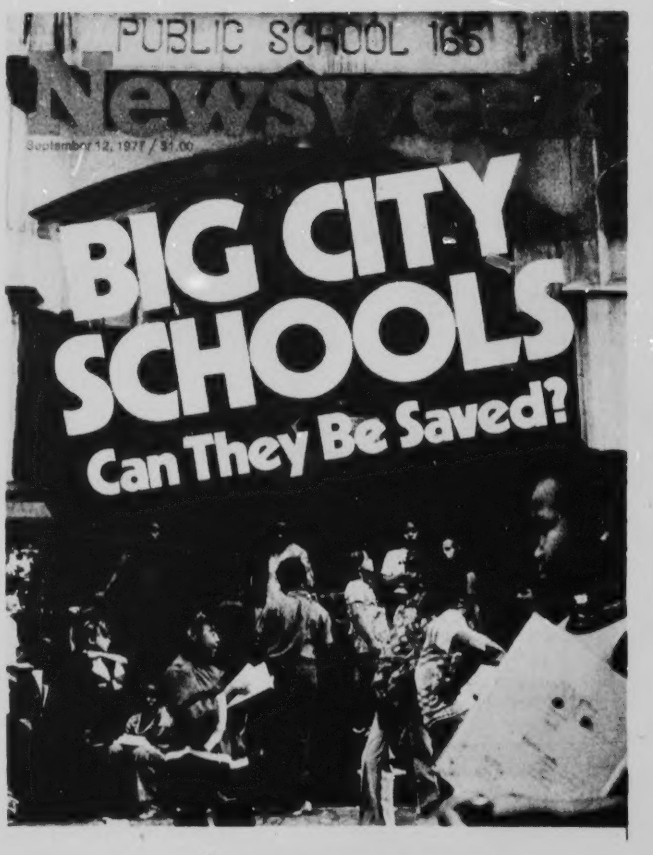
Part of the assimilation difficulties were caused by poor planning, by the failure to allow sufficient time after observations for field-workers to complete their studies. We asked for copy within a few weeks after leaving the field. Observers needed and took much longer. First drafts were scheduled by June 1, but not all were received until October and final drafts were received barely in time to hand out at the oral presentation of final results in Washington in mid-December. Part of the assimilation difficulties were caused by increasing the national survey to 22 groups of respondents, each with some questions unique to it and with item sampling to permit an even greater list of questions--and trying to do this within the assimilation period and within the 3 1/2 months prior to that oral presentation.

All in all we took about 18 months to do the job. It should not have taken so long. It is reasonable to say that the data would have been more useful in 6 months or 12 than they were after 18. We researchers should be able to do a high-quality national status study in a shorter period. Part of the problem was the instrument clearance process. We had a large amount of cooperation and good advice from the CEIS and OMB committees, yet found the process troublesome and delaying. Somehow there ought to be a way to do the sort of study the NSF wanted, one that would help them with policy setting and program planning, within a year.

The need for haste was practical. The circumstances within NSF and between NSF and other federal agencies changed considerably after plans for the study were drawn up. The bureaucracy often acts as if social policy research is independent of the political and personnel change, but a study ideally suited for one time and one agency director is a perfunctory collection of information for another head at another time.

Times continued to change rapidly across the nation and within the nation's schools. After the study was undertaken, accountability of the schools became much less a concern, financial circumstances improved, schools came to realize the demographic changes they would face, and court action became increasingly influential in what a teacher in the classroom would do. (If we fail to get distribution of these 1976-77 observations until the 1978-79 school year they will have less value than they should.)

Part of the value in either year, however, will be to make a point so easily forgotten: that the happenings of the nation's schools are not adequately reported in the popular or professional press. Happy news is not news. Ordinary news is not news. The feature stories in TIME, NEWSWEEK, and other major news media this past fall (1977), stories telling of hostility and violence in the schools, a large amount true in a few schools, was not a picture compatible with the conditions we found.* Boredom was much more common than hostility. Submission was much more common than rebellion. Pride was much more common than vandalism. Hostility, rebellion, and vandalism, though, were known in every corner.



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*In a brief story in The Guardian (September 18, 1977) entitled "Hate in the Classroom" reporter Jonathan Steele told British readers "There's peace but not much else in the integrated schools of the U. S. this term."

> *I sit in Row Z and look down across the rows of bent wood seats toward a stage now walled off by heavy canvas curtain. A small American flag and an electric clock mark the presence of time, but most other features mark the past. Now a bell rings and the present comes alive as dozens of students cross the auditorium to pass between classes. A quiet reverberating flow. Teenage boys and girls cast a curious, perhaps friendly glance, walk on. The reverberations come from echoing hallways, the bell again adding to the clamor. Almost every student quiet, but the system a din.*[*]

The quality of science education was, in a sense, very much the same. The national condition had not been well represented by the reports of College Board test scores, by the reviews of North Central or other accrediting agencies, or by expressions of outrage from Admiral Rickover and Frank Armbruster.[**] The views of such reports and people are important but they are usually greatly incomplete views of the national scene, based upon expectations both arbitrary and parochial. There are many different pictures of science education, many value commitments, even within a small community, certainly in a vast country. We beliive that we captured a more nearly valid national picture of science education in these case studies than have the nation's reporters and researchers, critics, and education's apologists. Quality of science education in the schools, as we found it was seen to be at least "satisfactory," and in many instances "very good," by most school people and parents. It could have been much better, but the obstacles to improvement were many, and the direction of improvement was not something on which there are agreement. If the wishes of citizenry and students had been followed better it is more likely that Mr. Rickover and Mr. Armbruster would have become even more indignant. The question of which philosophies, which values, will control the schools continues even when change in control is unlikely. If it takes a national trauma to give a small canal to its neighbors, to give the schools either to the people or to the science establishment would require an effort beyond comprehension.

We were ever beset with paradoxes; of indoctrinating youngsters to keep our freedoms, of going to extremes to keep things the same, of finding everything changing but all remaining the same. On one occasion it would seem that everybody agreed on what they wanted, but soon again all would disagree. The nation wanted a common classroom for all children, yet wanted each child freed from the constraint of slower and disruptive classmates. We thought about organizing this report in terms of paradoxes, for we found so many in the field. But we did not.

In the methods chapter we speak of "multiple realities." We believe that in reality, reality is multiple, rooted in the different perceptions of people. That does not mean that we consider all realities worthy of equal consideration. In a project such as this we wanted to encounter as may realities as we could, but we concentrated on several appearing more worthy of study than others. We chose a few views to represent the many.

Reality has levels of complexity, of course. But reality, being a creature of those who realize, can be simpler or more complex, depending partly on who is paying attention.

People sometimes ask for a clarification of school goals, and that is no more and no less than they are interested in. It can be as simple as that. And people sometimes ask for a clarification of school goals, and they are there pointing out that children are unwilling to learn, that parents are unconcerned about what the children do, that the learners are unprepared for learning, that teaching is over-demanding, etc., etc. And it is as complex and diffuse as that, or more. And it may be the same situation and the same people and the same moment on the clock. And it is not that those who see the complexity, "see through" the simplicity; because the situation is not complex until the reality of simplicity is no longer sufficient. It often is.

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[*] Site Visitors Report

[**] Frank E. Armbruster, The U.S. Primary and Secondary Education Process (Croton-on-Hudson, N.Y.: Hudson Institute, Final Draft, 1975). Also College Entrance Examiniation Board. On Further Examination. Report of the advisory panel on the Scholastic Aptitude Test Score Decline. New York, 1977.

We have asked large numbers of questions so that individuals could tell us how other individuals, especially large groups of individuals, act or feel. They found this quite difficult to do. They said they did not know. Apparently little sharing of ideas, little joint teaching, little visiting over classrooms had been occurring. Those classrooms were, it seemed, public school but private space. John Goodlad titled his book of the American school curriculum: Looking Behind the Classroom Door.*

We were privileged to share in some of that private space and some of those private realities. We found it comfortable to let the purposes stand for what they were, or to probe until we found other purposes. And paradoxes. And to report them all. We found a paragraph by Leo Tolstoy that helped us understand what we were doing:

> *A bee poised on a flower has stung a child. And so the child is afraid of bees and declares that bees are there to sting people. A poet delights in the bee sipping honey from the calyx of a flower and says the bee exists to suck the nectar of flowers. A bee-keeper, seeing the bee collect pollen and carry it to the hive, says that the object of bees is to gather honey. Another bee-keeper, who has studied the life of the swarm more closely, declares that the bee gathers pollen-dust to feed the young bees and rear a queen, and that is exists for the propagation of its species. The botanist, observing that a bee flying with pollen from one dioecious plant to the pistil of another fertilizes the latter, sees in this the purpose of the bee's existence. Another, remarking the hybridization of plants and seeing that the bee assists in this work, may say that herein lies the purpose of the bee. But the ultimate purpose of the bee is not exhausted by the first or the second or the third of the processes the human mind can discern. The higher the human intellect soars in the discovery of possible purposes, the more obvious it becomes that the ultimate purpose is beyond our comprehension.*
>
> *Man cannot achieve more than a certain insight in to the correlation between the life of the bee and other manifestations of life.*

Those are some of the things we would have said in the Overview.

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*John I. Goodlad, Frances M. Klein, and Associates, Looking Behind the Classroom Door, 2d ed. (Worthington, Ohio: Charles A. Jones Publishing Co., 1974).

Chapter B

THE CONTEXT OF PRECOLLEGE EDUCATION IN AMERICA TODAY

The schools are the offspring of society. They are both the image of society today and the shaper of society tomorrow. In America the shaping impact of schools--as direct influence on individual lives and the collective life--has diminished. Mass communications (primarily TV, advertising, and contact through travel) have made everyone everyone's teacher. The teacher is but a voice among voices.

Now as much as ever, the society outside school walls shapes the society within--as these musings suggest:

> *The TV hero ignores laws that seem constraining. And even the shy child carries that individualistic, destiny-wresting American ethic to school.*
>
> *The dental hygienist on the billboard wears a white frock and recites "evidence" ringing with authority, yet obviously devoid of logic. And the school teacher, even while abhoring the deceit of advertising, steps in and out of the same recitation.*
>
> *The employee--whether father, mother, or youngster--works loyally to fulfill some kind of production quota. And the student hands in a weekly homework assignment that fulfills "the contract" and keeps open the option of a someday admission to college.*
>
> *Shoplifting has become an economic rather than a moral issue. The only deterrent to looting is the possible brief pain of apprehension. The merchant's price is now generously increased to accommodate the likelihood of loss. And the child in the nearby school treats school property --window panes and books alike--as neither a matter of common-privilege ("to injure it is to injure me?") or of moral consideration.*
>
> *The politician presents himself as a man of the people. He/she promises not so much to protect each individual within his own customs and beliefs, but perhaps to help get special tax breaks for this and that group. And the school superintendent talks of common mastery of precise skills rather than the uniqueness of personal understandings in an education.*
>
> *The basic personal reaction to people like yourself: black, or businessman, or hitch-hiker, or woman, or citizen-band contact, is empathetic and genial. Other persons remain "unseen," tho sometimes suspected. It is the same in and out of school.*

Many parallels. The school is still a crucible, with outside values poured generously in. But the outer society does not determine the inner. Rob Walker's case study (GREATER BOSTON) makes the point magnificently, "the school walls are thick." You do not know what's inside by looking around outside. The teachers and students and administrators cannot turn a meagre lot into a charmed lot, but together they can make whatever they have a good place or a bad place to live and learn. (Our case studies show more good than bad.) Schools are captured in their environments--yet where the human chemistry is right, any nook or cranny can provide a rich opportunity to learn.

Many people wish schools were something other than what they are, but by and large, neither student nor parent nor teacher displays a longing for the school to be different from the society immediately surrounding.

Are they disillusioned? Perhaps it is the legacy of the strong emphasis on education in Lyndon Johnson's War on Poverty. Almost nobody "out there" expects the schools to lead the way to improve the social condition.* Realistic maybe, for the schools collectively are so much a part of that condition.

"Technological change demands social invention," said Victor Fuchs,** "if stability is to be maintained." But it is difficult for established societies to create new social inventions to solve their problems. We have tried. Title III of the National Defense Education Act and the National Institute of Education's dozen or so Experimental Schools, while succeeding in creating several new gardens, failed to reclaim worn-out lands. Few enduring, procreating, problem-engaging institutions resulted. Probably not because the design or funding was inadequate, but because theirs were the answers such few people were looking for. Few of the innovative designs acknowledged the fact that schools as they are are the paymaster and the stage for personal identity and aspiration of over 3,000,000 professional educators.

We begin a collective consideration of our Case Studies in Science Education by examining the general conditions in and around American schools today.

HARD TIMES - TOUGH NEGOTIATIONS

Times are hard in the schools. Money is scarce. Less so in communities like Phoenix and Fairbanks and Cheyenne, but even there we find squeezes.

It is not now so much a matter of a depressed economy. That was the key problem five years ago and remains one particularly in the industrial cities of the Northeast. Now the lack of money is more because state-funding of schools (40% of U.S. school costs are paid by the state)*** largely is linked "by formula" to enrollments, and enrollments are dropping some 2% each year.**** The costs of running schools do not drop when fewer children show up. Just as with the household budget, it is hard to make ends meet.

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*According to a 1977 Yankelovich survey, America's least affluent parents feel they cannot depend on schools for educating their children. More than four out of ten parents feel they cannot even rely on schools to teach children how to read and write. See the General Mills American Family Report on Raising Children in a Changing Society, a survey conducted by Yankelovich, Skelly and White, Inc. and reported in Intellect 106 (November 1977): 177-179.

**Victor Fuchs, The Service Economy. National Bureau of Economic Research (New York: Columbia University Press, 1968), p. 124.

***National Center for Education Statistics, Statistics of Local Public School Systems, 1972-1973 (U. S. Government Printing Office, 1976).

****(From the high point of national enrollment, 1971) National Center for Education Statistics, Digest of Education Statistics (U.S. Government Printing Office, 1975), Table 29, p. 36; and National Center for Education Statistics, Education Directory, Public School Systems, 1975-1976 (U.S. Government Printing Office, 1977), Table 1, p. xvi.

Some would say a time of diminished enrollments (it will last throughout most of the 1980's) should be a time of taking stock, planning, weeding out poor teachers and programs --and to some extent it is. But schools are more institutions for providing work for adults than they are institutions for providing training for children, and where hard times force a choice between the two--assuaging the work force is taking precedence.

Even with vastly higher prices for supplies--much due directly and indirectly to the oil crisis--labor costs continue to rise faster than other costs. The response of private industry is to automate and/or hire teenagers, as McDonald's and Safeway and Bank of America have done. More and more schools are looking for similar solutions. Superintendents talk about using good business accountability and refer to education as a matter of "production."

During the last fifty years of U.S. commerce, breadwinners have been driven out of production, out of merchandising. Many of the most literate now work to design, program, or ballyhoo the machines and teams of part-time help who do the work. Others have sought work increasingly in public agencies, including the schools. Superintendents and teachers alike have established work rules that in effect protect them from the "efficiency expert." Their arguments are not only self-serving, to be sure. The efficiency expert is often among the most naive as to what an education is, educators at least more the expert there. But school people seek ways that are kind to both teacher and learner, and the alternative costs of schooling are not weighted carefully in the equation.

It is easy to perceive the schools as part of the jobs program provided by government because private industry cannot or will not employ the huge number of well-educated clerical-managerial workers in America. In at least two of the sites we visited and in many communities the schools have the biggest payroll in town. If there were suitable alternative jobs for teachers, the schools could consider more alternative ways to operate (it certainly might be decided that teaching should become more personalized rather than less) and could perhaps revitalize the instructional program. But there are not and they cannot.

A combination of tough collective bargaining and worsening fiscal constraints is affecting the K-12 curriculum. The VORTEX and URBANVILLE case studies pinpoint the conditions--but such were evident in all our urban sites. Adjusting to the economic circumstances is largely a political process, less a pedagogical process.

Fewer school-age children. CSSE field observers were in the field studying school programs during the 1976-77 school year. National high-school enrollments for that year were the highest they had ever been. The junior high and middle school enrollments were down a bit, and the elementary school enrollments were starting to bottom out after a decade of decline. Because the schools had learned how to deal with crowding, rather little attention was being paid to the large numbers of high school students. Because the schools had not learned how to deal with diminishing enrollments, there was much concern about the adjustments in elementary school programs. Conditions varied a great deal from site to site, but the growing problems of declining enrollments were anticipated in most of these schools and others around the country.

Secondary schools will feel the forthcoming enrollment drops even more than the elementary schools have. Secondary programs are more fragmented and specialized, making them more dependent on a steady flow of students and funding, more vulnerable to the population cycles. The readjustment of secondary school programs will be more dramatic due also to the differences in organizational structure.

Some areas of the curriculum will suffer more than others. The enrollment changes will have greater effect upon courses of study based upon changing need and interest, for example, in science and mathematics. RIVER ACRES in Texas was an exception. In many places there is serious drop-off in enrollment in history and political science, on one hand, and growing interest in the electives of psychology, sociology, and anthropology. Department chairmen in California told of a great interest in sociology. Their remarks underscored a comment on enrollment by a curriculum supervisor in Milwaukee.

> *Civil rights has had a tremendous impact on social studies. Law and Urban Studies are the two biggest areas now. Government as such is not faring well with kids--almost dropping out of sight, economics too.*

The "biggest problem" facing the social sciences, he suggested, is to preserve choice for students striving for a sense of racial or ethnic identity while retaining a core of civic cohesiveness. His words proved to be prophetic: budget cuts in many of the sites were forcing boards to collapse multiple sections of the high school program into fewer areas of electives--again particularly noticeable in URBANVILLE and VORTEX--or to increase class size and the numbers of instructors teaching in more than one field, as in WESTERN CITY.

Elementary schools were trying to respond to the same pressures by closing schools and realigning attendance boundaries, threatening older areas with loss of "their" school, and precipitating board vs. neighborhood skirmishes. Given the additional thrust of desegregation mandates, such as in our GREATER BOSTON and Alabama sites, it is apparent that urban and rural settings alike are witnessing fundamental changes in the relationships of public schools to the communities they serve.

There is a very personal side too. "Riffing" is a term applied to "reductions in [teaching] force." The way it usually works is that the most junior teachers are fired each spring; the more senior of these are rehired in August, and assigned to a school where enrollments permit it. Naturally it is a trauma, and not only just for the younger teachers. In URBANVILLE, riffing triggered a strike as the school year began. Riffing adds to the growing complexities and stridency of collective bargaining. In a state where there has been a collective bargaining law for at least two years, 14% of 71 superintendents told us that reassignment of teachers has become a much larger issue due to the collective bargaining agreement.

New agreements between school boards and teachers unions are reflecting the concern teachers have about placement, such as does this language from the agreement at our VORTEX site:

Article 47

The Permanent Substitute

1. *A substitute teacher who fills a vacancy for a full year in the VORTEX Public Schools and who commences his assignment prior to October 1, shall be deemed a permanent substitute.*
2. *When a permanent substitute's assignment is concluded during the school year, he will be given five (5) days notice of the termination of the assignment.*
3. *When a permanent substitute's assignment is concluded during the school year, he will be assigned to any other vacancy in his*

field. If no vacancy exists, he will receive per diem assignment with permanent substitute benefits for the remainder of the year.

4. *No permanent substitute shall be required to perform any task not required of a regular teacher.*

5. *Permanent substitutes shall continue to be included in the teachers' insurance programs.**

Combined with a general surplus of teaching candidates throughout the nation, riffing fashions a dismal harbinger for efforts to put the best teacher in places most needed.

Other issues, once never considered are joining salaries, out-of-class duties and class size on the negotiation docket. Tenure by building, rather than by district (to limit cross-town reassignments), is such an issue--but now at least temporarily sidetracked by an August 1977 ruling by Judge Parsons of Chicago's Federal District Court.**

With such activism teacher associations are becoming stronger--even with a surplus of unemployed teachers registered at placement bureaus. Over 80% of all precollege teachers belong to an affiliate of the National Education Association or the American Federation of Teachers. There were 468 teachers strikes (by one count) in the nation's schools in the calendar years 1973 through 1975.***

As they get stronger the teacher unions find increasing dissension within the ranks. Some groups strongly maintain the professional ethic, that the welfare of the child comes first and that instructional reorganization is a union's top priority; others push harder in the trade union tradition for raising certification standards so as to admit fewer teachers to the profession. In many communities the leadership is being pressed by a belligerent subgroup to press for greater demands.

As developed in the assimilation chapters of this report, the picture of instructional programs in U.S. schools is one of great inertia--unmovable fixedness and unstoppable transformation. Yes, both.

The times call for utmost flexibility of institutional response, but the flexibility is seldom there. There are strong indications that the budget constraints and declining enrollments are blending with collective bargaining to restrict maneuverability. And bargaining inside the schools seems likely to become more identified with the general realm of public sector negotiations--with educational costs viewed as an integral part of municipal budgets. A brief overview of mid-1977 developments in four states attests to the gravity of school-related issues.

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*1976-1979 contract agreement between VORTEX School Board and VORTEX Federation of Teachers, pp. 28-29.

**Chicago Daily News, 15 August 1977, pp. 1 and 4.

***For example, out of the 255,899 graduates who completed teaching preparation in 1975 the 192,700 seeking employment exceeded by 90,950 the number of positions open (101,750) (NEA Research Memo 1976-2, June 1976). Sources for other figures in this paragraph were: National Education Association, "Status of Teachers and NEA Members, Special Memo I-6" (Washington, D.C.: NEA Research, July 1976); HEW, National Center for Educational Statistics, "Advance Report, Fall 1975 Statistics of Public Schools"; and U. S. Department of Labor, Bureau of Labor Statistics, "Work Stoppages Report," Nos. 483 (1975), 453 (1974), 437 (1973), (Washington, D.C.: U. S. Government Printing Office).

Tennessee--The legislature was considering a bill to revise the state's funding formula to give systems with more pupils more state money, while at the same time guaranteeing smaller districts wouldn't lose funds.

Illinois--Governor James Thompson had appointed a 23-member commission to consider the effects of state-required programs on school boards and local governments. He said a major problem local communities and school districts now face is sustaining state-mandated programs that aren't adequately funded.

Kansas--New legislation had been adopted which allows citizens to protest school closings and even petition for a referendum on the school board's decision. The new law requires any school district to publish reasons for closing a school, name of the school and names of schools to which pupils would be reassigned. Public hearings are required within 45-60 days of such a resolution, and if at least five per cent of the registered voters in the school district field a petition protesting the closing, a general election would be required.

Pennsylvania--Governor Milton Shapp was expecting a report from a special commission established in December to review the state's public employee bargaining law, which guarantees state and local government workers the right to strike and teachers the right to unionize.

The Pennsylvania State Education Association would like to see impasses resolved with binding "best offer" arbitration. That approach, however, was strongly opposed by both the Pennsylvania School Boards Association and the Philadelphia Federation of Teachers.

Historically, public schools have been regarded as a major contributor to the welfare of the total populace despite their focus on children and youth. In an era of community, state, and federal priorities in flux, an era of fewer youngsters and more oldsters, how the schools will fare is one of the seminal matters confronting this society.

THE CITIES AND THE SUNBELT

The CSSE project was conducted at a time of high levels of unemployment, inflation, energy use, and constraint on budgets. The school age population was declining. Only thirty-four out of seventy-four superintendents in the CSSE national survey responded that the science curriculum in their district had not been affected by budget cuts recently. Major demographic shifts were also apparent throughout the United States--a promising explanation for some regional variation in science teaching and learning.

Comparative analyses of the case studies will underscore the importance of a presentation made by a Rand demographer, Phillip Morrison,* at the 1977 meeting of the American Association for the Advancement of Science:

> *The essentially private and unregulated movements that make up migration flows are now being scrutinized for the newly perceived costs they create, both at origin and especially at destination.*
>
> . . .
>
> *This new dispersal of population, coupled with a sharp slowdown in over-all growth due to a lower birthrate, has altered local and regional population growth rates. The new patterns are having significant fiscal, social, and political repercussions.*

Much of the movement is "white flight" from the Northeast to the lure of the "Sunbelt," that area ranging from Georgia and Florida across the Gulf states, through Texas, New Mexico, and Arizona to southern California--and by some calculations including Colorado, Virginia, and Washington, D.C. The end of nearly three and a half decades of heavy military involvement in the Pacific, the nation's increasing reliance on truck transportation, the coupling of low pay with rising educational levels in the South, and the first non-agricultural population gains in many rural areas are the circumstances noted in the 1976 Report on National Growth and Development.**

Three tables illustrate the changes. In Table B-I we show population changes in large metropolitan areas between 1960 and 1974. In Table B-II we present percentages of the total U.S. population by size of place for 1950, 1960, and 1970.

Population changes already underway reveal that in the years immediately ahead a trio of factors will probably levy great influence on public affairs, including education. For several years increased numbers of young people will be starting households and seeking full-time employment. The number of older people is increasing. A substantial decline in public school enrollments has begun. In Table B-III we portray projected population changes by age groups over the next fifteen years.

As can be inferred from these data, the out-migration from northern cities is both to outlying rural areas in the same region and to the Sunbelt. In effect, the migration is creating new urban centers in the South and shrinking the existing ones in the North. The educated white migrants from northern cities to new suburbs and to the Sunbelt partly comprise what has been called "the middle-class poor" who extend their credit limits to buy homes and maintain middle-class ideals. Most are working at least as hard as ever.

The "white flight" has left behind something of a population stagnation in most inner cities, especially those in the Northeast. The destitute predominantly non-white inhabitants of places like Watts in Los Angeles, Bedford-Stuyvesant in New York City, the

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*The Scranton Times, 22 February 1977, pg. 7.

**Washington, D.C.: U.S. Government Printing Office, 1976.

Table B-I: Population Change in Metropolitan Areas Between 1960 and 1974*

Standard Metropolitan Statistical Area	Average Annual Population Change	
	Migration 1960-1970	Migration 1970-1974
Sunbelt		
Albuquerque, New Mexico	+ 1700	+ 7000
Anaheim-Santa Ana-Garden Grove, Calif.	+55300	+ 44300
Atlanta, Georgia	+23300	+ 25500
Denver-Boulder, Colorado	+16500	+ 22800
El Paso, Texas	- 2900	+ 5300
Houston, Texas	+31700	+ 28300
Los Angeles-Long Beach, California	+26900	- 82500
Memphis, Tennessee, Arkansas, Mississippi	- 400	- 4300
Miami, Florida	+25500	+ 32500
Pheonix, Arizona	+19000	+ 39000
Other		
Bakersfield, California	- 500	- 1500
Boston, Massachusetts	NA	NA
Chicago, Illinois	+ 1800	- 56500
Detroit, Michigan	- 1700	- 38800
Fort Wayne, Indiana	+ 1200	- 1000
Indianapolis, Indiana	+ 3800	- 3800
Jersey City, New Jersey	- 4600	- 8500
Milwaukee, Wisconsin	- 3700	- 6800
Minneapolis-St. Paul, Minnesota-Wisconsin	+11800	- 6500
New York, N.Y. - New Jersey	-31900	-125500
Peoria, Illinois	- 800	- 300
Philadelphia, Pennsylvania-New Jersey	+ 5700	- 27800
Pittsburgh, Pennsylvania	-16600	- 22300
Salt Lake City, Utah	+ 800	+ 1800
Seattle-Everett, Washington	+18800	- 15500
St. Louis, Missouri-Illinois	+ 2400	- 26300
Trenton, New Jersey	+ 1200	+ 2000
Washington, D.C.-Maryland-Virginia	+42700	- 3500

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*Adapted from U.S. Bureau of the Census of Population and Housing. PHC (2) General Demographic Trends for Metropolitan Areas, 1960 to 1970, Characteristics of the Population, Part 1, United States Summary; and Current Population Reports, series P-25, No. 618.

Table B-II: U.S. Population by Size of Place for 1950, 1960, and 1970*

CLASS AND SIZE	PERCENT OF TOTAL POPULATION		
	1950	1960	1970
United States	100.0	100.0	100.0
Urban	64.0	69.9	73.5
Places of 1,000,000 or more	11.5	9.8	9.2
Places of 500,000-1,000,000	6.1	6.2	6.4
Places of 250,000-500,000	5.4	6.0	5.1
Places of 100,000-250,000	6.4	6.5	7.0
Places of 50,000-100,000	5.9	7.7	8.2
Places of 25,000-50,000	5.8	8.3	8.8
Places of 10,000-25,000	7.8	9.8	10.5
Places of 5,000-10,000	5.4	5.5	6.4
Places of 2,500-5,000	4.3	4.2	4.0
Places under 2,500	0.4	0.4	0.4
Unincorporated parts of urbanized areas	4.9	5.5	7.5
Rural	36.0	30.1	26.5
Places of 1,000-2,500	4.3	3.6	3.3
Places under 1,000	2.7	2.2	1.9
Other rural	29.0	24.3	21.3

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*U.S. Census of Population: 1960 and 1970, Vol. 1, Tables 19 and 20 (Washington, D.C.: U.S. Department of Commerce, Bureau of the Census).

Table B-III: Population Changes by Age Groups, United States, 1972 - 1990*
(Percent Change Based on 1972 Population)**

Age Groups	Projected Change by 1980	Projected Change by 1990
All ages	+ 6.2%	+14.5%
Under 5 years	- 2.4%	+ 3.0%
5-17 years	-11.7%	-13.4%
18-24 years	+13.0%	- 3.8%
25-34 years	+35.1%	+52.8%
35-44 years	+11.4%	+62.0%
45-54 years	- 5.0%	+ 4.3%
55-64 years	+10.4%	+ 6.6%
65 and over	+14.8%	+32.6%

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*National Growth & Development: 1976 Report (Washington, D.C.: U. S. Government Printing Office, 1976), p. 37.

**Assumes 1.8 average births per woman in childbearing ages 15-44. However, fertility rate dropped again in 1976 for fifth consecutive year.

West Side of Chicago, and parts of Boston, Detroit, Washington and even Atlanta were featured in the August 29, 1977 edition of Time in an article entitled "The American Underclass." The authors claimed that "the underclass presents our most dangerous crisis, more dangerous than the depression of 1929, and more complex."

> *A most crying long-range need is to improve public education. As the poorest of the poor have inundated inner-city schools, it has been easier for educators to concede the trappings of success: passing grades, graduating doplomas, than to teach the skills necessary for living and working. Ghetto school officials need to enforce their lax truancy rules, putting more pressure on parents to insist that their children attend, and need to concentrate rigorously on the reading, writing, and math skills required to get ahead in an advanced society.**

Such simplistic solutions to the problems are found in all the media, and in many of the CSSE quotations. How easy to say "enforce truancy rules." Does it take into account that most teachers are white and not living in the areas of urban decay? Or the absence of jobs or promise of jobs that will help youngsters from deteriorated neighborhoods escape? There is indeed a great problem--with a full mix of education and economic factors. Remedying the education side without remedying the economic seems greatly unlikely. The South Goes North** offered insight into the migration of millions of farm workers from the South to the throbbing urban centers of the North between 1940 and [illegible] [illegible]zation of agriculture and employment opportunities for the unskilled in [illegible] and the outgrowth of World War II were forces that increased minority pupil [illegible] in the urban-metropolitan areas, particularly of the northeast lake fronts and seaboards of our country. From the influx into the large urban school systems of the children of the newly-arrived minority families emerged new and different student behavior. Blackboard Jungle and High School Confidential*** vividly portrayed the inability of inner-city schools to adapt to the culturally changing school populations. This change included the cultural reactions of the minority and non-minority children whose families were not new to the transitional neighborhoods; West Side Story**** exemplified ethnic ("non-minority") reaction to the influx of Puerto-Ricans to certain New York City neighborhoods.

Teaching the poor. In the sixties federal funding to ghetto schools increased the number of pedagogical personnel to teach the growing and changing student population. Universities were obligated to prepare teachers capable of going into ghetto school districts to provide minority children with the educational opportunity equal to that enjoyed by white children in the suburbs. The task was too difficult. Teachers Talk***** documented the frustrations of beginning elementary school teachers as they were inducted into ghetto school staffs.

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*"The American Underclass," Time, 29 August 1977, pp. 18-19.

**Robert Coles, The South Goes North, Volume III of Children of Crisis (Boston: Little, Brown and Company, 1967).

***Evan Hunter, The Blackboard Jungle (New York: Simon and Schuster, 1954) and Lewis Meltzer and Robert Blees, High School Confidential, MGM, 1958.

****Arthur Laurents, West Side Story (New York: Random House, 1958).

*****Estelle Fuchs, Teachers Talk: Views From Inside City Schools (Garden City, N.Y.: Doubleday & Co., 1969).

As the failure of centralized school boards to provide for the education of poor and disadvantaged minority groups became apparent there emerged a strong advocacy for decentralization and local community control. The Ocean Hill-Brownsville school district in Brooklyn drew America's attention: parents demanded participation in selection of the school staff.

Through 1970 the northern inner-city ghetto school was often a modern building looking out-of-place among dilapidated tenement houses. Steel doors and wire mesh window coverings by then were common. Many teachers were fresh out of college and began experiencing difficulties with discipline in classrooms comprised primarily of city-born and newly arrived minority children. These children seemed to have little of the motivation of the docile and well-read children of the teacher training classroom. While northern cities were still thriving many students dropped out of school and were able to gain unskilled employment. The job situation changed. Youngsters who dropped out or were expelled were not able to find employment. The schools were still not able to transform disadvantaged youth into the model students envisioned by employers, college admissions officers, newspaper writers and most other adults.

Many middle class families were leaving the cities to live in the suburbs and more lately in the Sunbelt. Business and industry were leaving the big cities and the out-migration of middle class families gathered new momentum, further eroding the tax base. Declining elementary school enrollments contributed to the need to constrain budgets for education in the cities as elsewhere. Cutbacks in resources and lay-offs for pedagogical and ancillary staffs upset urban classroom dynamics further. Confusion, fear and general loss of security was experienced by students, teachers, administrators, parents and communities. Teacher unions felt internal contention as teachers of different subject areas and levels allied themselves against one another--particularly as to what seniority system would come into effect during the imminent teacher lay-offs.

Students who were previously marginal about their commitment to learn in school were less disposed than ever to make the best of the classroom scene. Many would sneak out by one of the many exit doors--as in a CSSE high school in GREATER BOSTON (site visit report). A change in curriculum, "back to basics" seemed to some like the most promising option in light of the decaying conditions and the public's outcry against funds spent for well-intended but failing program innovations. In 1977, after years of deterioration, urban school systems are in great distress--but each of CSSE urban sites have reported signs of new stability.

But arrest of deterioration--even if true--is little cause for celebration. Urban areas continue to decay; immigrants continue to arrive and transients move into neighborhoods that were fairly stable only a few years ago. We find new waves of transitional neighborhoods, already decayed but still getting worse.

The Sunbelt from 1940 to 1960, experienced the out-migration of both highly educated people and farm workers, bound for Detroit and the industrial cities. But since 1960 many of the highly educated departees have been replaced by highly educated northern arrivers. An agricultural revolution drastically reduced the number of farmers, leaving many, especially blacks, unemployed and unable to adapt to non-agricultural employment. And still today many of the illiterate youngsters and old people are concentrated in the poorest sections of the Old South. The growth of the northern cities in the sixties seems to be mirrored in the southern cities in the seventies.*

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*James F. Doster, "The Old Way and the New" in The Rising South, ed. R. H. McKenzie, (Tuscaloosa: The University of Alabama Press, 1976).

For the northern cities President Carter's aides have predicted a greater federal emphasis on neighborhood preservation.* The youngsters of the inner city underclass might benefit from the relevance in learning, understanding and experiencing a "science" of neighborhood preservation. For the cities of the Sunbelt, is there any way to avoid the mistakes made previously in the North? Can good schools be maintained along with a strong commitment to equal educational opportunity during this period of growth? The same dysfunctional classroom dynamics that occurred in northern cities may occur in the Sunbelt cities--particularly if northerners migrating south take along that common mind-set: "Well, first, I'm going to get mine."

THE SCHOOL AS SURROGATE

Ruth Love, Oakland's distinguished superintendent and former director of the "Right to Read" program recently told an audience of administrators and school board members that "Public schools are being asked to do things we used to pray to God for."** Few seem to feel that the response now is any livelier than it was before. Precollege education may be asked to do things once left to the Almighty, but its central place in the American aspiration faces strong challenge.

Historian Henry Steele Commager,*** in a chapter titled "The School as Surrogate," described the demands this way:

> *In the past we required our schools to do what in the Old World, the family, the Church, apprenticeships, and the guilds did; now we ask them to do what their modern equivalents, plus a hundred voluntary organizations, fail or refuse to do. Our schools, like our children, are the victims of the failure of our society to fulfill its obligation to paideia.*

This is not to say that the modern equivalents are inactive. The libraries are bustling, rebuilding. Sesame Street and other children's educational television programs have a wide audience. "Scout troops," 4-H clubs and "Outward Bound" still continue to dispatch youngsters on educational adventures. Girls' athletic programs are booming, thanks to federal equal opportunities legislation, giving young women educational experiences and acculturation long available to young men.

But getting an education from these is somewhat like learning science from Ripley's Believe It or Not. Sooner or later the facts and great ideas are all there, but disjointed, without the profound sense of relationship that comes with an apprenticeship or a good collection of readings or course of study. The Beatles, Archie Bunker, First Officer Spock, and the Fonz have contributed to a million liberal educations, escapist to be sure, but liberating youngsters from old sanctities and ideals dear to the sixth grade teacher. The modern equivalents are at work, Professor Commager, but as you said, not supplanting the school in caretaking American education.

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*"Answering the Cities' Cries of Distress," U.S. News & World Report, 13 December 1976, p. 30.

**Gordon Hoke, Report on the Annual Meeting of the American Association of School Administrators, February-March 1977, at Las Vegas, Nevada. Reprinted in CSSE P. 11:41.

***In School Worlds '76: New Directions for Educational Policy, ed. Donald N. Bigelow (Berkeley: McCutchan Publishing Co., 1976), p. 23.

How to share the role of the community-wide education with other institutions continues to be a puzzlement for the schools. Continuing education and adult education responsibilities have increasingly been assumed by community colleges, even so much so that the YMCA, church groups and others offering supplementary courses cannot compete with the subsidized tuitions of the new program. Here again, the "cottage industries" and "corner groceries" are being driven out of business--whether or not their offerings are better or poorer in quality than those with the modern "delivery system."

The libraries, the park districts, the community colleges, the museums, the cable television contracts (which have municipal regulation) are areas where intergovernmental cooperation with schools is inadequate to the need. Debate over the role of public libraries vis-a-vis public schools sparked the following exchange between two school board members in one of our case study sites.

> *It [the library] is not only one of the remaining founts of culture, but also is a central part of the total education of the students moving through the school system. All the disciplines have at their core the necessity of and access to books. There is no comparable public educational institution in the city or in the school system itself . . . The library must be recognized as an indispensable part of the educational system of the City . . . The school board must increase its funding of the . . . Public Library.*
>
> *It's crazy, really crazy, you know! We started out helping the library in a "crisis year" as a gesture of good will. Now we've caught ourselves, and are expected to increase our aid to other institutions when we can't even cope with our own demands.*

State-Federal requirements. The demands to which the latter speaker referred are the increasing obligations accompanying state and federal programs. These programs are an expression of real social need, but are based on the notion that the schools can do additional social and educational service with little or no change in organization, personnel or funding. "Categorical-aid" programs, in spite of Richard Nixon's effort to get rid of them, continue to grow. They carry enough funding or threat of loss of funding so that, though voluntary, the school cannot really choose whether or not to participate. So the mission of the school grows more expansive and more intricate.

The California program for bilingual education is a case in point. First, this excerpt from an interview with two elementary school curriculum supervisors:

> *Funding provides an aide in every classroom, helps with the class size, and also provides a curriculum specialist at each experimental site. In many cases, it also provides a "community-contract" aide . . . Math and reading people are made available from the district-level office . . . At least twenty [of thirty-six] schools are receiving some form of aid and the number may rise to twenty-four or twenty-five next year.*
>
> *The situation does create problems of management. We dream of management from one source, [but] not management by funding source. There has to be accountability. It should be such that classroom teachers don't have to spend eons of time, filling out forms.*

> *We have some schools receiving aid in several categories--for example, early childhood education, Senate Bill 90, Title 1, Senate Bill 22-84, and now Senate Bill 1329, plus upcoming bills for special education. Each one of these programs has particular areas that it is looking at, areas it wants to measure.*

Our WESTERN CITY report further indicates the welter of categorical programs of federal and state origin. One by one, by direct statement in the legislation or in the subsequent program regulations, each program places a formal planning-accounting-reporting burden on the schools. This burden is no small escalation. It is not easily assumed by the informal planning, accounting, and reporting activities traditionally operating in the schools, nor by the formal planning-accounting-reporting mechanisms of other federal-state programs. Each categorical program can be expected to set forth requirements for a newly designed or renovated bookkeeping operation. The new requirements make good sense, considered ahistorically, without regard to existing operations in the school, but they add greatly to an already encumbered system.

Efforts are being made by the states to get the schools to be more efficient and productive by imposing "accountability" requirements. Led by Michigan in the late 1960's and followed by most states (extravagantly by Florida and Oregon), legislation was passed to get the schools to pursue a more uniform set of objectives and to monitor progress with state assessment testing. Early efforts to link performance to state funding of local districts and to other decision-making were impolitic and impractical. The whole notion that schools can use student performance data to improve district programs has yet to be validated. Furthermore, there is a yet-insufficiently-calculated risk of diminishing the opportunities to learn concepts and relationships by emphasizing the facts and basic skills covered by the tests. As House* has demonstrated, the "accountability" aim is questionable; the technology is far from adequate.

In analyzing Gallup Poll data regarding the public attitude about school accountability, Harry Broudy** said:

> *The school is being asked to change its priorities from cognitive to environmental, personal outcomes. If, as authorities in social work and sociology insist, the most potent forces in these non-cognitive conditions of learning are the home and the community, the accountability of the school for providing them becomes problematical.*

Diverse needs. Teachers are at times expected to be surrogate parents, grandparents, siblings, priests, therapists, wardens, biographers, babysitters, and friends. They are intermediaries for the schools which are at times expected to feed the hungry, restore the deprived, redirect the alienated, energize the lethargic, and calm the hyperactive, as well, of course, as educate the ignorant, train the naive, and inspire the downhearted. Many school people enjoy the challenge. Others are frustrated.

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*Ernest R. House; Wendell Rivers; and Daniel Stufflebeam, An Assessment of the Michigan Accountability System (1974); reprinted in The Evaluation Center, "Evaluation Series Report #2" (Kalamazoo, Michigan: Western Michigan University, 1976).

**Harry S. Broudy, "The Demand for Accountability: Can Society Exercise Control Over Education?" Education and Urban Society 9 (February 1977):241-242

A junior high school teacher vented his feelings at repeated demands for his school to be a better "melting pot," a meeting place of the cultures, a place to honor the pluralism of our society.

> *I'm not a bigot! I'm not a sociologist!! I don't know the answers. If your concern is that you want a kid to know about science there are ways of dealing with that. But for some you have to make things so simple and "relevant" that there is really no application after that. What's important is that they know English!*

Anti-social behavior is often linked to low self-esteem. The schools are at times charged with the responsibility of developing attitudes of self-worth, personal and group identity. In Milwaukee, they had developed a seventh-grade textbook entitled The American-His Heritage-Rights-Responsibilities.* In it appear these statements:

> *He (mankind) can think about what is here and now, what was in the past, what can be in the future, and what can never happen. Only humans can do these things.*
>
> *Actually, you (the student) will note that all aspects of our culture have been affected by our heritage as a nation of immigrants.*

The longings for brotherhood, for a sense of identity, for a student body free of aggressive hostility are real and to be respected, of course. Unfortunately, when teachers face youngsters having little of a work-ethic, having little fear of the teacher's authority, having little appetite for gaining power through academic learning, having little desire to become more like the teacher is--then the schools have little collective expertise in teaching self-esteem or cultural appreciation.

The following excerpt from our GREATER BOSTON case study (p 11:11) reveals the commitment of some teachers to deal simultaneously both with academic and nonacademic needs.

> David and Steve both find that they need to plan their lessons for the lower ability groups quite differently to the higher ability groups. . . .
>
> Both teachers are working through the part of the Earth Science course that deals with the atmosphere and goes on to look at weather and climate. Both of them are trying to establish the idea that air has substance, and that it has characteristic properties. We have seen how David has set about this problem by having the students work through a number of experiments (which are not all in the text), which cumulatively he hopes will give the students a feel for the key concepts. It is crucial to his approach that the students do the experiments themselves (even if

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*Department of Elementary and Secondary Education Division of Curriculum and Instruction, The American-His Heritage-Rights-Responsibilities (Milwaukee: Milwaukee Public Schools, 1971), pp. 19 and 180.

> they knew what will happen) because the tactile sensations involved are as important as the demonstrations and explanations.
>
> With his low ability group Steve too is trying to get the students making things. But feeling they would be bored by the kinds of air pressure experiments David is doing, he has them making models of atoms using polystyrene spheres. The students could set their own level by choosing which atom to build, and then having coloured the spheres (red for protons, blue for neutrons and white for electrons) had to assemble a model using wire and a wooden base board.

But it suggests too low an incidence of success.

Spokesmen for the schools say they would like to do the many things people want them to do, but they are prevented from doing so by the shortage of funds. Funds are indeed precious, but there is real question as to whether more money would buy better education. Cutbacks in funds for chemistry supplies and for individual instruction on musical instruments are clearly and directly lowering the quality of instruction. However, if full funding were restored, only a small portion would go for those. As indicated in the previous section, most of any newly recovered funds will pay for existing professional services seen now as below a just and deserved wage level.

The need and propriety of additional funding was documented repeatedly in our eleven case studies. In Columbus, Ohio the schools were closed for several frigid weeks last February, partly because natural gas rates went up beyond the ability of the school to pay--not only because the gas was in extremely short supply.

Increased expectation of the schools is seldom matched with proportionate increases in funding. Budgets do actually go up, but not in proportion to the inflation rate or the rise in program goals. So in effect the schools have less cash for purchasing what they would like to have in the way of counseling services, textbooks and duplicating machines. They would like to be able to operate in the style of a central government agency or private business. But most cannot.

And most cannot do the myriad tasks their communities collectively assign them. The public has its eyes on many goals in many different directions, a few of them even in contradiction with each other, such as student attitudinal goals of self-reliance and accepting the interdependence of individuals. We asked high school counselors, a group that sometimes sees themselves as the applied social scientists of the schools, about it this way:

> Parents, students, and teachers--talking among themselves or with others--say what they want the schools to be doing. They say different things, but do they really disagree?*

Essentially none of them told us that people agree about what the school should be doing, though more thought it a disagreement over technique rather than purpose.

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*CSSE Survey

Broad and narrow aims. Teachers know they cannot satisfy their pluralistic publics. They know they will be increasingly embarrassed as the public learns more and more about what they actually spend time on, what the students actually become knowledgeable about. Administrators know it. This realistic reassessment is probably behind the strong teacher/administrator support of a "back to the basics" curriculum.

We were surprised. We expected to find parents and economically-distressed school critics advocating more emphasis on the basic skills of reading, spelling and arithmetic, with teachers arguing back that these skills do not add up to an education--but many teachers were "the advocates" more than anyone else around. Perhaps they wanted to be accountable for an assignment they knew they could succeed at, and to consider that whatelse was taught was a bonus rather than a general obligation.

Well, that is one way to deal with the problem. If the expectations of the school are unrealistic, pare them back to the "do-able." Such was the advice several years ago of Carl Bereiter* who contended that the schools are relatively ineffective even at teaching the substantive ideas of science and the humanities, that they should stick to areas where their success has been documented, to the teaching of basic language and arithmetic.

The demands of schools are great, but not impossible. Many teachers, many school districts have been quite successful over the years. The schools in Glendive, Montana; Scottsdale, Arizona; Miami, Florida and Brewer, Maine have lived up to most expectations of the community. Many observers from the outside would scoff at what they consider to be overly modest aspirations. And many citizens within those communities shake their heads in disbelief at things the schools do and fail to do. But most citizens believe (as Gooler** found in 1970) schools should pursue a broad array of goals and that academic responsibilities should continue to be assumed primarily by the schools.

The following exchange occurred in a downstate Illinois kindergarten center on the first day of school. Our observer approached a woman, a mother perhaps at 30-32 years of age. Most of her life had been spent in southern Illinois, though in several communities. She was retained at least once in grade school and dropped out of school in the ninth grade.

> *Mother: When I was a child I fell downstairs. My mother thought it must have harmed me. But we didn't have the money to do anything about it. I don't think too well, but I sure don't think I'm mentally retarded.*
>
> *Observer: (a long question about the importance of students demonstrating a positive attitude toward learning)*
>
> *Mother: Some students have it; some don't. Personally, I hated school. Michael [her oldest, a kindergartener] loves it. He wants to come here even when he's sick. I guess my attitude was poor.*
>
> *I was scared; nervous. Was always made to hurry, to work faster. But I just couldn't work faster, so I was left behind. But the*

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*Carl Bereiter, Must We Educate (Englewood Cliffs, N.J.: Prentice Hall, Inc., 1973).

**Dennis Gooler, "Strategies for Obtaining Clarification of Priorities in Education," (Ph.D. diss. University of Illinois, 1970).

things they [teachers] do now! My, this kindergarten! Schools have changed a lot. My husband and I, and my woman friends, think kids are being treated better today. And I'm learning things in those Head Start parent meetings.

Observer: . . . the reorganization of schools?

Mother: Some parents are against that--what do you call it?--consolidation? Well, you'll have trouble with that. I'm afraid of big schools. I think other people are too.

Observer: . . . what classes would you like?

Mother: I would like to learn more about child care. Also, I don't cook too good. I'd like to know more about foods, about sewing. Kids today have, I guess you'd call "advanced learning." We never had that! I was real good in art and music. Liked them. Had lots of fun in those classes. But I just wasn't too fast--not too much learning. Guess I'm slower than others. I was always behind.

Observer: . . . office of the state superintendent in Springfield?

Mother: Yes, it does provide for equal education opportunity.

Observer: How do you know?

Mother: Because of the Head Start and this kindergarten. Do you know about the D.V.R. program [Division of Vocational Rehabilitation]? It really helped me years ago. A counselor got me into it. It's very important for the underprivileged and handicapped. Guess I'm sort of handicapped.

Observer: . . . everybody has strengths and weaknesses.

Mother: As far as learning goes, I am handicapped. Learning and knowledge have always been important, but I'm so slow.

Second Mother: [approaching, appears agitated, even hostile; later will have a serious clash with one of the kindergarten teachers]: There's not much school left.

Mother: Hello. Yes, time goes fast. [proudly] But Michael is going to be in Head Start. And so is his little sister. They're going to be smart. You know, I'm not very smart.

Second Mother: [with a trace of bitterness] Oh, I don't know. I've had two years of college. Now I'm here [divorced]; making $1.60 an hour, paying a babysitter 50¢ an hour--and for what?

There is a change in the public. It is a change in confidence in the schools to accomplish their responsibilities. People are less optimistic than they were fifteen years ago. Then, and for years earlier, no matter what the youngsters learned, they could go to work or on to further schooling. And now, and maybe for many years to come, no matter what the youngsters learn, they can go on to further schooling, but not to work. Perhaps it is easier to believe that what is wrong is the schools, rather than political-economic systems. Any grave challenge to the centrality of the schools in the American aspiration may be more a matter of loss of the American dream. So far at least, for all the wistfulness, there is not a substantial turning away from the schools as the instrument of learning and socialization.

DESTINY CONTROL

Perhaps no American institution has been more vulnerable to competing claims and shifting priorities than the public schools. Changing legal interpretations of "due process" and "equity," those Constitutional bulwarks, have had a direct impact on school policies and practices. The success of Russia's Sputnik just twenty-five years ago galvanized a concern for political-military strength. We reacted by overrunning the previous obstacles to federal intervention in education, passed the National Defense Education Act, and sought counseling and instruction for our future scientists and engineers.

And more. Contemporary obligations to acknowledge, even to honor, cultural and linguistic differences among people have seriously complicated the work of a school system built partly for the assimilation of disparate immigrants into a homogeneous society.* Racial desegregation and mainstreaming of handicapped children are among the more recent and continuing obligations of the schools to disregard and diminish the differences among people--to the end that we achieve a more equitable life in a more homogeneous society.**

From coast to coast there is widespread antipathy to "homogenization." Now, this could be taken as evidence that the cultural enclaves still successfully resist the melting pot idea of American destiny, evidence that the people of this country now have the more classical Western road of "upward mobility" via successful business or professional practice plus the more parochial road of social success according to the standards of the local community.

And there is such a continual restatement of instructional objectives and reorganization of school offices. Now this could be taken as evidence that the yearnings of dedicated individuals and pressure groups do redirect the work of the schools, that is, that the individual American is attaining a greater control over his destiny.

Most people we have talked with are not persuaded by such evidence. They see little increase in the leverage individuals have. The rhetoric of remediation of our problems, e.g., mainstreaming, should not be taken as evidence of remediation. Indeterminacy, e.g., organizational change, should not be taken as evidence of social sensitivity. The pressures continue. The buffeting of the school is real. But it is difficult to see the response as responsive to the troubles of modern life. The social standards set in the earliest colonial schools still predominate in today's schools.

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*An insightful document by a former U.S. Commissioner of Education on what the schools did to help "liberate" immigrants and minorities from their heritages was aptly entitled, "Cowboys, Indians, and American Education" by Harold Howe II, in Picking Up the Options (Washington, D.C.: Department of Elementary School Principals, 1968).

**Or perhaps, as Joel Spring claimed in The Sorting Machine: National Educational Policy Since 1945 (New York: David McKay Company, 1976), it was just part of the unrecognized National Educational Policy, to perpetuate the benefits of the meritorious and to quiet demands for correcting the inequities of the political-economic system.

> *While the rhetoric of national politics had been liberal and egalitarian in the past, it had been counteracted quite effectively by the conservatism of local practice. After World War II, the federal government became an increasingly important factor in local affairs as a result of the activities of the courts as well as the impact of such legislation as public housing or urban renewal programs. Unfortunately, the national government tended to implement its rhetoric with policies and funding whose effects were cosmetic rather than remedial--there is little sign of any genuine willingness to pay the costs involved in a serious attack on social problems, even if the competence to deal with them were present. Unimplemented changes in legal status can be had at little cost; the cost of implementation, as the busing controversy of the 1970's shows, can become an unmanageable burden. For the most part, efforts by the federal government to improve the lot of the poor and unfortunate were only tokens of intent and not serious efforts at remedy--an epidemic is not counteracted by immunizing and treating a small and select portion of the total population.*

The author of these words, social scientist Eugene Meehan* faulted this nation for an inadequate effort. Was he wiser than an Oregon parent who said, "It doesn't pay to keep trying to do what you can't do."? The prevailing attitude in the schools today is to forget the idea of reshaping a national destiny through the schools, and to make things better here and there.

Why all this interest in destiny control? It is so much the myth of what the American schools are all about. Freedom from religious oppression. New lands. The Westward Movement. Horatio Alger. Jackie Robinson. We surprise the European visitor to our schools. Back home the schools are to perpetuate a system. Here too, but the talk, the talk is about the chances your grandfather never had, that a lad born in a log cabin who studied by candlelight could become President, that there is no subject matter any pupil cannot learn, given time and good teaching.

Others dream and say "Why?"
I dream and say "Why not?"

Mostly fantasy, Bobbie Kennedy, but part of the American dream--and still a useful dream, if homesteading, damming rivers, or teaching math are your business.

Plymouth Rock shone through the mists of James Coleman's study** of school segregation and its purported effects on children. Destiny control, the feeling that one has the power and the freedom to direct one's own life and manage the surrounding circumstances, was judged by Coleman to be a crucial variable separating the "successful" from the "unsuccessful" youngsters in the classroom. The plight of both parents and children in places like our GREATER BOSTON site and our Alabama site are captured in these further words by Professor Meehan:*

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*Eugene J. Meehan, Public Housing Policy: Convention Versus Reality (New Brunswick, N.J.: The Center for Urban Policy Research, Rutgers University, 1975), pp. 172-173.

**James Coleman, Ernest Q. Campbell, Carol J. Hobson, James McPartland, Alexander M. Mood, Frederic Weinfeld, and Robert L. York, Equality of Educational Opportunity, U. S. Department of Health, Education and Welfare, Office of Education, National Center for Educational Statistics (Washington, D. C.: U. S. Government Printing Office, 1966).

> *Ironically and tragically, the factual helplessness of the inner city's population was increasing rapidly at the very moment when that population was being urged to entertain rising expectations about the quality of its own life and the life of its children.*

Expectations do continue to change. Conditions in some cities, it appears to some observers, are "bottoming out." In our middle Atlantic seaboard study, for example, we saw residents in the school neighborhood accepting more responsibility for improving their houses and landscapings. And the youngsters in those schools hearing over and over something like, "You don't have no rich uncle; you don't have no professional football career; if you gonna make it, it's gonna be by reading these books"--always with the tone that "yes, it is going to happen."

Powerlessness. Destiny control is a matter of concern for others than students, of course. The teachers are not optimistic about changing the system, but they have seen their salaries get better, and they think the unions can help some more. Though superintendents are facing a job longevity of but two to three years, they can count on "reorganization" to keep them from serious trouble for a year or two. They feel terribly constrained by state and federal demands and the unpredictables of community pressure.

Even school boards, the supposed ultimate power in the American educational system, are seeing themselves as having little control over the destiny of the schools. They once were the spokesmen for the teachers to the community, drawing more they thought in wages and privileges than the community was ready or even able to pay. Now teachers have formed collective organizations as a means of job protection as well as monetary advancement.

Boards considered themselves the patrons of the children, but students have brought pressures directly and indirectly to obtain wider choices of courses and various student rights. To the activist, parental involvement, special interest groups, basic civil rights, all are closely related to shaping one's own destiny, but to board members, this activism and the state and federal requirements are draining away the opportunity for the local community to have the schools it wants.

The State Board of Education in Pennsylvania saw fit to impose a Students Rights and Responsibilities Code on the state's 505 districts. District representatives protested--in a class action suit. The Court ruled that the Legislature "specifically gave local school boards the right to regulate student conduct and discipline" and cautioned the State Board that it could not assume it was a "super school board."**

And so at every level, even at the "super board level"--in spite of the obvious frequent changes in what the schools are doing--there is the feeling that you have less to say about it than you used to, that you don't have much to say about the destiny of the schools or their children.

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*Op. Cit., Meehan.

**The Scranton Times, February 25, 1977.

YOUTH AND ALTERNATIVES

If one is seeking a baseline for examining adolescence and the schools, nothing better is likely to show up than Paul Goodman's Growing Up Absurd: Problems of Youth in the Organized Society.* Unfortunately Goodman had relatively little to say about the education of girls--a matter obviously growing in importance. His insights concerning the loss of alternative ways for young men to establish a feeling of identity continue to be relevant. They have been supported by clinical studies. In a document prepared for the Mental Health Study Center, National Institute for Mental Health, Liebow wrote:**

> *The centrality of work, then, is not new to human experience, and it did not arrive with the appearance of capitalism and the Protestant ethic . . . What does seem to be relatively new, however, is the appearance of widespread, systematic nonwork--unemployment--as an integral part or by-product of the ordinary functioning of society.*
>
> . . .
>
> *Both the youth who has never worked but who sees [this] situation as his probable future, and the man who had experienced it retreat to the street corner where others like themselves, in self-defense, have constructed a world which gives them that minimum sense of belonging and being useful without which human life is perhaps impossible and which the larger society gives up so very grudgingly or not at all.*

Jerome Bruner*** also explored the realm of life prospects in a 1972 article partially focused on youth. He noted that adolescents were turning to a type of "deep play" such as "chicken," involving even an incomprehensively high risk of life.

What is characteristic of the whole, however, sometimes appears very rare in the parts. The CSSE case studies seldom use such dramatic tones in portraying the youth culture. More common are the colors of football warm-ups and pom-poms. More common are the squeaks and squeals of skylarking in the corridors. But even those distract eye and ear from the shades of gray of boredom, disinterest in student government, and disbelief in the stories of how it used to be or how it ought to be.

The kids still long to get on with life. Forty per cent of the black youngsters want work but cannot find it. Twenty per cent of the white. The desire for jobs is evident in the readings of URBANVILLE and RIVER ACRES. Commitment--even of teenagers--to an irretrievable way of life is evident in the farming community around BRT. The linkage between cars and jobs is all so apparent in WESTERN CITY.

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*Paul Goodman, Growing Up Absurd: Problems of Youth in the Organized Society (New York: Random House, 1967).

**Elliott Liebow, The Human Costs of Unemployment, ed. A. M. Okum (New York: W. W. Norton & Co., 1972), pp. 1-11.

***Jerome Bruner, "Nature and Uses of Immaturity," The American Psychologist 23 (August 1972): 704-705.

Automobiles continue to serve as the most obvious artifact of the youth culture. Vans, trucks, and Hondas assume increasing stature. Jobs are essential for maintaining access to wheels, for gasoline is 58.9¢ even at "the cut-rates." Jobs are essential for purchasing the accoutrements of regional good-life--ski equipment in greater Seattle, leather coats in GREATER BOSTON. Jobs are not apprenticeships; jobs are NOW.

More working, fewer jobs. It is no easier for a nineteen-year-old to get a job than a sixteen-year-old. The market is flat that way. Of course what looks like a good job to a sixteen-year-old boy or girl is not likely to look good enough to one three years older. The situation varies from place to place.

The schools are increasingly tolerant of youngsters working, and even make accommodations for late arrivals and early departures. In an urban New York City classroom every ten minutes or so a youngster slips in or a youngster walks quietly out, without challenge, legitimized at least in part by "the job." Even in the comfortable suburban school, over half of the high school youngsters have after-school work. That has an effect on extracurricular programs, to be sure, and is in turn an effect of fewer funds for special classes and extracurriculars. Boredom, cars, jobs, no money, no hobbies, no jobs--it's a complex pattern.

Only a few edges of the pattern seen in our sites show up as distressful as the conditions cited by Bruner, Liebow, and Goodman. Students acknowledge "a lack of motivation" for school work. Teachers recount the troubles of teaching lower-ability students. The folks in the RIVER ACRES schools deal at length with such matters. Similar concerns are found in all eleven sites. Particularly common is the loss of youth interest in following traditional pathways of academic progress.

Youth jobs bring immediate choices but not long-range choices. After working a year the sixteen-year-old does not get promoted to a seventeen-year-old's job. It doesn't work that way. He or she quits. Maybe because the job no longer is good enough. Maybe because it's just no longer necessary or fun to work. It's not clear. What is clear is that nobody is offering career work to teenagers. According to economist Eli Ginzberg* only three out of ten new jobs now being created are "good jobs." McDonald's has its famous Hamburger U. for the training of McDonald management people--but it takes about as many recruits as the National Football League. So young people pass into their twenties with both an education and an appetite for spending money greatly exceeding the long-term work opportunities available to them. Seven years later, about at age twenty-five, they finally get into long-term work. Nobody seems to know why it takes so long.

Already, in a sense, "overeducated," the two main answers to the high school graduates' question "Now what?" are: more education or hanging around. The influence of "overeducation," the prolongation of formal schooling prior to entering the work force, appears to be one of the chief undercurrents in the troubled waters of public education. Its relationship to structural changes in world economies was featured in the May 23, 1977 edition of Newsweek. Noting similar conditions throughout western Europe, the authors compared them to the state of affairs in this country:

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*"The Purpose of an Economy," Jobs for Americans, ed. Eli Ginzberg (Englewood Cliffs, N.J.: Prentice-Hall, 1976), pp. 1-7.

> *The youth-unemployment disease that has plagued the United States since the early 1960s has crossed the Atlantic. More than 2 million people under 25 may be out of work in the nine Common Market countries, and at the economic summit in London this month, youth unemployment emerged as one of the West's thorniest issues. The danger is that disillusioned and sidelined youths may take a sharp political turn to the left. "We just can't afford to have young people out on the street at the mercy of radical rat-catchers," says West German Chancellor Helmut Schmidt.**

The Chancellor's strong words are a reminder that traditional long-range goals also appear to be losing their hold, not only on youth but on other segments of society.

The youngsters are in trouble because they are idle, they are idle because they do not work; they do not work because they are ignorant and lazy; they are ignorant and lazy because the schools have failed to do their job. So goes a common line of reasoning. No doubt there is some truth in it, but not much. Most youngsters want very much to work. Most have strong preferences as to the kinds of work that are worth doing. And they have energies that compare well with other segments of the population. There are political complications here.

Brendan Sexton,** formerly director of the Center for Leadership Training, United Automobile Workers, has warned that the educator who is concerned with talent development, but who at the same time divorces himself from the political problems of the economy is "fooling himself and misleading the people he seeks to educate and train." The implications for both schools and the social order may have been stated by Robert Merton several years ago.***

> *In the American Dream there is no final stopping point. . . . At each income level . . . Americans want just about 25 per cent more. . . . (but of course this "just a bit more" continues to operate once it is obtained). . . . The family, the school, and the workplace--the major agencies shaping the personality structure and goal formation of Americans--join to provide the intensive disciplining required if an individual is to retain intact a goal that remains elusively beyond reach.*

This striving, competitive, materialistic side of the American dream, whether the working of avarice or fulfillment, cannot help but confine youth. Not in wants, they want the diversities of the universe--but confined in opportunity to pursue those wants. It is a time of job shortages, a time when initial capital needed for franchise or farm is enormous, a time when family control, "old boy networks" and union quotas, choose, legitimate, and limit who will get the good jobs, the tenure tracks, the career opportunities. These are not inventions of the 1970's, of course, but they are the realities of the youth-opportunity world this decade.

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*David Pauly, "Europe: Idle Youth," Newsweek, 23 May 1977, p. 53.

**Brendan Sexton, "Opening Up the Options," (Address prepared for Symposium on Talent Development, University of Illinois, May 1970), mimeo.

***Robert K. Merton, Social Theory and Social Structure (New York: McGraw-Hill, 1962), pp. 136-137.

Advertising has urged us to excess. Art and literature have revered individuality and downplayed modesty. The Women's Movement has prompted women to work, and for all its justification, has put wives in competition with youngsters for work. Privilege in the society has become increasingly related to the expense account, so becoming corporately salaried has become among the holies of our time. In seeking more we are saying to the twenty-year-old as well as the sixteen-year-old: your time will come later.

The society is liberated, freer, less constrained. The alternatives for youth, in terms of expression, are many. The alternatives for youth, in terms of career choices, are much more constrained. How much so is not well known--how much the schools contribute, if any, to the broadening or narrowing of life opportunities is not readily apparent.

Increasingly, schools have been offering alternative curricular programs. For many years a student could take a more college-preparatory or more vocationally-related sequence of courses. Special tracks have been available for children with learning disabilities and physical defects. Electives have made the school course-catalogue appear to be nicely diversified.

Individualized schooling. Teachers once championed the idea of taking a child where he/she is and helping him/her along his or her own developmental, experiential path. You do not hear much of that talk today. Most counselors and teachers impress upon you the importance of meeting minimum requirements and common terminal objectives. There is "individualized" instruction in many schools but it means proceeding to a common goal at your own pace, with relatively little contact with teachers or other learners. With everyone on the same track there are few choices for youngsters to make other than whether or not to try.

Interest in "career education" is on a five-year high throughout the country despite the evidence that it has no standard interpretation. The flowering of community colleges, with their two-year terminal programs and ease of access, contributes to preparation of youth for jobs, but they still offer "school," not "work," and the assurance of employment in most fields is not high.

As youngsters became increasingly disillusioned with the war in Vietnam and other aspects of our culture, both sacred and folly, they dropped out of school. And schools, usually at the initiative of disillusioned young faculty members, created store-front academies and alternative schools to lure them back and to keep others from dropping out.

The school's offering of alternatives is usually, perhaps as it should be, to satisfy parent concerns more than student. The description of the alternative school in ALTE is an interesting case in point (p 3:101). Some of the more recent alternative schools concentrate on teaching the basic skills and traditional values. Private and parochial schools continue to offer parents many alternatives, but most are not real alternatives for the young. An effort to diversify alternatives was tried in the "Voucher-Plan" experiments, but even if they had struck a popular chord, they would have been for parents more than youth. Perhaps that is as it should be.

Research on learning styles and aptitude-treatment interaction* has not shown a way for the schools to contribute more to the diverse individualities of youngsters. The school's role is an uncertain one. Youngsters do not seem to feel that the schools have too limited a selection, or that they limit their later selections, but we do not really know.

We know too little. The problems are too large. Too much is expected of the schools. The pressures are too many. It is a gray background against which we examine eleven school science programs.

Readers will find one special theme running throughout our eleven case studies and this entire report. It is nicely described by the words of Martin Trow,** reporting on a discussion among sociologists as to what their discipline might offer to the (then) newly-created National Institute of Education:

> *One theme that underlay much of our discussions was the tension between the broad currents of populism in the society, which we seem to agree are growing in strength, and the importance of the training and formation of elite groups, and the conditions for elite achievement. I think it is perhaps the central tension in American society, and naturally shows itself very clearly in many educational institutions.*

Our case studies captured both the positive and negative effects of this tension. The picture we obtained from any one site, from all together, is fractured, incomplete, sometimes contradictory--as is all human drama. There are moments of truth, moments of vision. There are illustrations in the following pages of administrators, students and especially teachers, hanging on, fashioning creative responses to complex and distressing situations--of course some of their own making. In most places we visited, we found the will to prevail. And new ideas. It was Thomas Jefferson whose philosophical and political battles with Hamilton formally launched the struggle outlined by Trow and who first reminded us that "where there is no vision, the people perish."

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*Lee J. Cronbach and Richard E. Snow, Aptitudes and Instructional Methods: A Handbook for Research on Interactions (New York: Irvington, 1977).

**In a letter to Professor Burton R. Clark, Yale University, August 3, 1971, p. 5.

THE NATIONAL SCIENCE FOUNDATION*

The National Science Foundation was created nearly thirty years ago as an all-purpose science organization of the United States government. Almost from its start, NSF has adopted a position that, as the government science organization, it should be concerned and involved with science education in the country. This involvement has focused more on quality than quantity in the sense that the emphasis has been on improving the quality of science education rather than on increasing the number of persons who pursue scientific careers. The program to effect improvement in science education has had two general related thrusts: curriculum development and teacher education.

Most people asked to date the start of NSF involvement with science education would probably respond that it started with Sputnik I (1957) when the launching of the first Soviet satellite emphasized the tremendous progress of the U.S.S.R. in science and technology. While Sputnik I confirmed the Russian capabilities, they had been recognized earlier by NSF, and the program to improve science education was started before the appearance of Sputnik I.

The first teacher education efforts were in 1953 when two summer institutes were conducted. One was for college teachers of physics and the other for college teachers of mathematics. The first institute for secondary science teachers was held in 1954. The teachers education program grew quickly and in the peak year of 1968 over forty million dollars was spent on education for over 40,000 teachers most of whom were secondary teachers. The teacher education program has been reduced since 1968 and in 1975 about ten million dollars was expended for various kinds of teacher training activities.

Much of the teacher education activity was done in support of the other programmatic emphasis, curriculum development which is known formally as Course Content Improvement. Support for curriculum development started in 1956 for the project to prepare new high school physics materials. The support was to a group called the Physical Science Study

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*The content of this section is based for the most part on the following sources:

Milton Lomask, A Minor Miracle: An Informal History of the National Science Foundation (Washington, D.C.: National Science Foundation, 1976).

Dorothy Nelkin, "The Science-Textbook Controversies," Scientific American 234 (April 1976): 33-39.

Suzanne Kay Quick, "Secondary Impacts of the Curriculum Reform Movement: a Longitudinal Study of the Incorporation of Innovations of the Curriculum Reform Movement Into Commercially Developed Curriculum Programs," (Ph.D. diss., Stanford University, 1977).

John Walsh, "NSF Education: Basic Issues Still Unresolved." Science, 15 July 1977, pp. 233-236.

The reader with a strong interest in the history, controversies, and impact of the science education efforts of NSF is referred to these sources.

Committee and the project has become well known as PSSC. Over thirty Course Content Improvement projects have been funded since that time. Among the more well known are Biological Sciences Curriculum Study (BSCS), Chemical Bond Approach (CBA), School Mathematics Study Group (SMSG), and Man a Course of Study (MACOS). Funding for curriculum work reached its peak at about twenty million dollars in 1968 and has declined to about six million dollars in 1975.

Regardless of relative costs the science education program of NSF has been large enough that it should have had a major impact on science education in the country. Indeed the evidence supports the expectation. The Quick study documents considerable evidence of curricular, course, teacher, and student impact consistent with the goals of NSF.

The kinds of impact, however, are not equally valued by all. Consequently a considerable amount of controversy has been stimulated by the program, especially the Course Content Improvement aspect. Some of the controversy arise from imagined impacts, but that does not mitigate the concern.

There are three general themes in the controversies. One theme reflects a concern about Federal control of the schools through imposition of a nationwide standard curriculum. NSF has been exceedingly sensitive to this issue and has done many things to insure that they do not become directive. The evidence thus far is that this issue represents an imagined impact. Quick argued in her study that the science curriculum was more unified or common across the nation's schools prior to NSF than it is now. She suggested that the increased amount of variation is attributable at least in part to the curriculum work of NSF.

A second theme is that the content of the course has been changed so that the course does not teach the important content. This issue has been especially noticeable with the mathematics curriculum and the controversy about the "new math."

The third theme indicates a basic difference in values or beliefs among sectors of society. BSCS and MACOS materials have been severely criticized by some because they either fail to recognize alternative explanations or present explanations that are regarded as subversive to the "truth."

The political pressures on NSF from these controversies have become strong and have forced the Foundation to become extra careful in its science education efforts. It appears to some that NSF is being forced to withdraw from the leadership role that it has held and to assume a responsive role. Efforts in science education must now be justified on the basis of a needs assessment study. One might speculate that the justification will be best received if the needs are those expressed by a politically viable group.

Three needs assessment type studies were initiated by NSF in 1976. The results from the three studies will be used to make and support policy and program decisions for the science education program. This report is of the findings and recommendations from one of the studies, Case Studies in Science Education.

Chapter C

RESEARCH METHODS USED

Jo Ann Day and Robert Stake

Project Framework

In this chapter we describe the research methods used to obtain and present multiple case studies in science education to the National Science Foundation (NSF). Our study was one of three* funded by the NSF to assess national needs identified in a Request for Proposals (RFP), dated September 16, 1975. Our field work was carried out in three phases between September 1976 and November 1977. The three phases of the project consisted of case studies observations, site visits, and a national survey. While these activities are listed in order, they were planned and executed in three overlapping phases, approximately:

Case Studies	September 1976 - May 1977
Site Visits	November 1976 - May 1977
Survey Operations	August 1977 - November 1977

AIMS OF THE PROJECT

The major purpose of this study was to describe the status of pre-college science education in the United States in the 1976-77 school year. Issues and existing practices and outcomes were found, explored and described by researchers with the intent of providing another link between two camps--the camp of school people in each local community and the camp of national education policy makers. It was recognized that each camp had its own perceptions of what is needed and desired within a nation's school districts, and what is needed and desired for a nation's school system. The camps overlap, yet remain distinct. The case study descriptions were expected to be useful first in Washington, but later around the country as well, as people of all kinds struggle to meet the needs of a nation for science education of high quality.

CONCEPTUAL AND METHODOLOGICAL FRAMEWORK

Seeing rather than measuring was the activity of this project. "Issues" were central foci, guiding the seeing, organizing the understanding. We sought vignettes and devised scenarios, representations of experience, to illustrate the issues. What principally we hoped to see was "how much science is being taught (and) the obstacles to good science teaching." (proposal)

During the contract period we prepared statements, i.e., extended memos, to guide the project staff and others as to conceptualization and operation. Some of these statements will be included here, as is Number 20 on the next page.

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*The other two were reported as: Iris R. Weiss, Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education (Research Triangle Park, North Carolina: Center for Educational Research and Evaluation, 1978); and Stanley L. Helgeson, et.al., Status of Pre-College Science, Mathematics, and Social Science Education 1955-1975, 3 vols. (Ohio State University: Center for Science and Mathematics Education, 1977).

CSSE STATEMENT NO. 20
ON SEEING AND MEASURING

September 12, 1976

It is natural to see. It is natural to measure. Seeing and measuring are not the same act.

But they are even more difficult than we suppose. The common notion is that when one measures one sees the same thing but sees its amounts. As if one were seeing through glasses having graduated-scale markings on them. Measurement glasses, however, do much more than scale the view. Much more difference there is between seeing and measuring.

There is a transformation from experiential perception to representational perception. The observer switches from actor to director. He/she gives up the direct impression of the thing, perceiving it no longer as another being, a whole object, a member of the physical populace, and perceives it then as a bearer of properties, or even merely as an array of characteristics. This is no small transformation.

When I find myself in the company of a rose I see it. I do not see its redness, nor the Washington Monument its tallness, nor Professor Bronowski his intelligence. In order to talk about them--and perhaps even to think about them--I am always putting on the measurement glasses, and of course I see then, at least partly, each as a collection of properties: its brilliance, its tallness, its redness.

Getting ready to measure may be more like changing mindsets than putting on glasses. Taking vitamins, going on a diet, downing a martini, or submitting to sodium pentathol may be more the analogue. They change mindset, changing one's ability to respond, changing one's experience itself. Now one fits into different clothes, into different roles, into different valuings. And these changes bring changes in strength and power.

The way most of my researching colleagues want to see the world is through the properties of things. The way most of my teaching colleagues want to see it is to see things as things.

Putting on glasses that focus on properties, scales, and amounts changes the perception. Perhaps only a little, as sunglasses do; perhaps a lot, as reversal prisms do. Whether the distortion is slight or great, whether the change results in more or less comprehensibility, the impression gained is different from that for the unaided eye.

I do not know whether the unaided eye is more or less likely to see the truth. But it is important for me to realize that the perception of things with an orientation to properties, with an orientation to measurement, is "corrected" vision. Measurement is common and natural, but it is "corrected" vision.

Whether or not such vision moves us closer to truth is a matter to worry about. Many of us have not been worrying because we have been taught that when we measure we are closer to truth than when we just see.

The difference between seeing and measuring seems small when Experience is the heat of the day and Measurement is the column of mercury in a thermometer. It is because of the commonness of looking at the thermometer, or hearing its amounts, and realizing the correspondence to our feeling.

For most of our measurements in education we do not have such a correspondence.

Measurement is not just holding a ruler to what we see, but seeing something to hold a ruler to.

Issues. Seeing something to hold a ruler to was not our aim. This research project was experience-oriented. We relied heavily on intensive field observations and interviews as a means of recording differing images and meanings. Issue-based images and meanings--more than properties and measurements--were to form the conceptual structure for the work.

In CSSE Statement Number 21 we defined an issue (for our purposes) in the following manner:

> An issue is a circumstance about which people disagree. It usually involves a condition having some features causing (or believed to cause) certain effects. These effects are valued differently by different people--so they disagree as to whether and how the condition should be changed.
>
> The ingredients for an issue then are the condition, the effects, the relationships between condition and effect, the different valuing, and the alternatives among courses-of-action for changing conditions.
>
> (It is true that the contention might be due more to disagreement as to whether or not a relationship holds than to different valuing of the effects. Either way, issues are points of contention.)

The issue list was one conceptual structure for observations throughout the project. To be sure it was an evolving list, one that was expected to be modified and changed by involvement in the sites. The issues were originally conceived of as "foreshadowed problems:"

> *Was it Benedict or Malinowski who spoke of "foreshadowing problems?" One, perhaps both, and more recently, Lou Smith, urged the field observer to specify the big questions that take him/her into the field. Such questions are the basis for deciding what will be observed.*
>
> *Foreshadowing problems are not "the hypotheses to be tested." They are not that durable. Though apparently the most important questions at the outset, they are expected to give way to still more important questions. The issues that dominate the final report may be reformulations of the original issues or may be some that emerge during the investigation. The investigator needs to avoid overhonoring and overkeeping the chosen foreshadowing problems, but also to avoid approaching the scene with too little an idea as to what to watch and what to record.* *

At the outset of the CSSE project it seemed there were three large foreshadowing problems:

> How is science being taught today?
>
> What are the current conceptualizations of science in the classroom?
>
> What are the current encroachments upon the science curriculum?

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*Robert E. Stake, "Seeking Sweet Water: Case Study Methods in Educational Research" (Urbana, Ill.: Center for Instructional Research and Curriculum Evaluation, AERA Training Tape Cassette, forthcoming).

The foreshadowed problems constituted the starter list of issues. The list soon changed and continued to change over the course of the study. We expected that local issues would emerge as observers attended to such concerns as the following:*

- Different Conceptualizations of Science
  - Science as inquiry
  - Science as explanation
  - Science vs technology
  - Social science vs social studies

- Perception of Conflict Between Science and Culture
  - Science and Religion
  - Social science and cultural taboos
  - Moral issues and science teaching

- Place of Science in the Curriculum
  - Core subjects and electives
  - Preparation for college
  - Vocational relevance of science
  - Integration of subjects

- Science Instruction
  - Appropriateness of teacher preparation
  - Organization for teaching, class periods
  - Testing, assessment, teaching for the test
  - Laboratories, materials, projects
  - Science clubs, competition, honors
  - "Driving-force" persons, "Mr. Science"
  - Changing roles for teachers

- Changes in School or Community that may affect the science (including math and social sciences) curricula
  - Diminishing budgets for education
  - Emphasis on the basic skills
  - Emphasis on bilingual programs
  - Adversarial roles of teachers and administrators
  - Increasing role of parents and citizens
  - Desegregation actions

Some issues were found in the news media: back to the basics, declining enrollments, fiscal problems and conception of science education as vocational and environmental education.

It had been anticipated that five or six major themes would emerge as the most important issues across the sites. Possibly they would be some identified in the professional literature. However, before the end of the project, the five major clusters of issues listed above had developed into many clusters, with sub-issues and new collections of sub-issues to form new clusters. We had expected to organize the final report assimilation chapters around the predominant issues, but our authors found such an organization too indifferent to many important observations--so we shifted to a more taxonomic table of contents.

Seventeen substantive questions were raised in the RFP to guide case study observation and analysis in this project. Direct responses to these questions appear beginning on page 19:16. Data for those answers are inherent in the quotations and descriptions of each case study. The questions direct one's attention to the general roles and practices of today's science educator. These roles and practices are essential background circumstances for understanding the issues we found at the sites and in survey returns from around the country.

Vignettes and Scenarios. The commitment "to see" more than "to measure" invited the use of vignettes and scenarios. These distinctions were made for our purposes:**

> A vignette is a small illustration or perhaps one facet of an issue, only suggestive, but poignant. It will often be a wisp of a dialogue but sometimes grows beyond the size of anecdote to become a short story. It may be the trace of previous action, such as the smudge of lip prints on a photograph. Momentarily it is "figure," but shades off into the larger meaning of the issue. In this study we will label something a vignette only if it is reported as an actuality.

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*CSSE Statement No. 2.

**CSSE Statement No. 21.

> A scenario, on the other hand, for us, is a contrived illustration of one or more issues, its parts joined together not only to indicate conditions and to suggest courses-of-action, but to provide a stimulation to discussion and description of personal points of view. The scenario may include vignettes or be reconstructed from them. Questions, sometimes calling for categorical answers but usually calling for explanation or narration, will be a part of the scenario.

An example of these differences can be seen in the following statements as it relates to a particular issue.*

> Issue: Molecularization of the curriculum, breaking down the course content to small pieces of knowledge and skill; to facilitate teaching, learning, and retention; possibly resulting in a narrowing of the subject matter, diminishing differences between learner scoring on tests; perhaps requiring new orientation and skills of the teacher; perhaps enabling administrators to state school aim and accomplishment more accurately, to be accountable; possibly consistent with desires to return "to the basics" and to teach responsibility and respect.
>
> Vignette: One frustrated sixth grader in District Alpha, whose teacher was very proud of the rapid progress he was making in the individualized math program, was asked,
>
> "What kinds of answers do you want to put down?" "Any," he replied, "as long as they agree with the key. You see," he said, "it doesn't matter if you are right or wrong, it's according to whether it's what the key says. If you put down 2/4 and the key says 1/2, you get marked wrong even if they are the same thing. If the answer really was 1 and the key had 2, you'll get marked wrong, if you put down the right answer." "How do you work so fast, then," he was asked. "I just try doing each page quickly using one way. If I get them all marked wrong, I try another pattern. Sooner or later, I find the right pattern and get the whole page right." "Don't you then try to use that pattern again?" "No! Each page is different."
>
> Scenario: Excerpt from Scenario D. The superintendent of the Dorchester Schools is telling everyone about the new objectives-based curriculum in the local schools. Each teacher has identified the basic goals of each course--the knowledge and skills each collected and bound in a bright orange-and-black notebook, one copy of which has a prominent place on the table each evening the school board meets. Is this the way it is in your school? Is there any danger in breaking things too small?

Vignettes are found throughout the case studies and site visit reports. The CSSE personnel used vignettes from their own experiences on site team visits as well as vignettes from other reports to discuss the issues.

Our final choice of scenarios is found with the survey findings (Chapter 18) and within the assimilation chapters (12-17). Scenarios as contrived illustrations were constructed originally from foreshadowed problems and vignettes found in our field observations. In the process of developing the scenarios they were presented to respondents at all case study and trial sites** in the form of issue-scenarios.

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*CSSE Statement No. 21, vignette adopted from Stanley Erlwanger, "Case Studies of Children's Conceptions of Mathematics," (Ph.D. diss., University of Illinois, 1974).

**Our planning included the use of trial sites. These sites (both rural and urban) were used to provide information for and reactions to our scenarios, plans for site visits and survey questions.

These scenarios were meant to reflect more than immediate problems to a local district, yet to retain a sense of immediacy to local teaching and learning in a way most research hypotheses do not. They were neither highly general nor highly localized questions.

The site visit team* originally spent a major portion of its onsite time pursuing these issues via the technique of an issue scenario. A typical session included a small group of people--site visitors and respondents. A scenario was presented to this group to find out what kinds of teaching and learning were occurring, how science was conceptualized by teachers and students and how various things happening in the community and school were affecting the science, math, and social studies curricula.

Teachers, administrators, students and residents of the community were asked to respond by drawing upon their experience in reaction to the scenario presented. Conceptualizations of issues were to be those held by these groups. The intent of the development of issues into scenarios was that they would be used in the national survey. Survey questions were designed around a particular scenario to confirm or disconfirm the importance of the issues nationally.

During preparation of the scenarios, we took them to the field and raised several questions of teachers and others. We asked questions about each scenario to ascertain:**

1. the typicality of the situation depicted
2. the accuracy of the representation in the scenario
3. the importance of the issues
4. suggestions for remedy of the problems at issue
5. other important issues we should be raising

After further refinement based on the responses, the scenario format was set up for inclusion in our mail survey. The eight that continued to be seen as vital at the case study sites were to be included. Categorical responses were added for survey use, though many open-ended questions were retained. This is described further in Chapter 18.

As the months passed, the scenarios became less used at the sites. They served nicely as "ice-breakers" for discussion, but school people often felt the scenarios were unsatisfactory representations of conditions at their site, sometimes even because (it appeared) only one part of the scenario did not correspond. But also, the scenarios presented so complex a picture that on-site respondents concentrated on detail when we wanted to talk about major movements. It was seldom that the issue of the scenario was considered unimportant, unrecognized, or inapplicable, but it was too seldom couched in the appropriate context for them. The discussion often would continue with the issue presented by the respondents in a context more fitting to their situation. As a representation for conditions broadly, the scenarios became less and less useful.

The conceptualization of the issues of science teaching continued to be incident-oriented rather than property-oriented until the end of the field work. The scenarios were used in the survey, but the case study writers found the effectiveness of their descriptions depending on details and circumstances idiosyncratic to a site, even though the issues themselves appeared to be quite general.

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*Carrying out the second phase of the project. See p. C:38 for the site visit calendar. By the sixth site visit, eight issues had been selected for survey questionnaire use. Site visit interviewees continued, of course, to be asked about a broad range of issues.

**CSSE Statement No. 22.

TWO ORIENTATIONS FOR STUDYING EDUCATION

We aimed to identify and understand major issues as they were perceived in the field by teachers, administrators, students, parents, and curriculum supervisors. Their perceptions were sought and recorded by intensive unstructured interviews as well as by structured questionnaires. Their teaching and learning situations were observed formally and informally. Data were gathered, analyzed and reported in a combination of two methodological orientations: naturalistic and formalistic.

We used both orientations, but the naturalistic orientation more. It might also be said that we were more qualitative than quantitative, more issued-based than property-based, more case-particularistic than population generalizing, more subjective than objective, more experiential than rationalistic, more empirical than idealistic, and more hermeneutic than positivistic. But in each instance, of course, we were some of both.

Natural Orientation. We tried to see and to record the educational phenomena as others were seeing them. We tried not to impose special constructs to represent typical situations or underlying bases of covariation. Of course we brought along our theories, our memories, our tabulations of history, and our "etic" issues--and to a certain extent those formalisms influenced what we viewed.

We were looking for what was particular to individual persons, or to individual classrooms, in individual sites. If it existed, we sought a community view, or all-school view, but we tried to make sure that we understood any of the views more particularized than that.

> It is implied by the "definition of the situation" that there is no one-to-one correspondence between an objectively real world and people's perspectives of that world, that instead something intervenes when events and persons come together, an intervention that makes possible the variety of interpretation which Schutz calls "multiple realities." According to this view, the same events or objects can have different meanings for different people.*

These differing views, these multiple realities, were apparent in each of the case studies and site visitor reports. They were apparent in the responses to survey questions as well, but there, both questions and answers were predominantly formalistic. Still, answers to the open ended questions came back oriented to the concrete particulars of experience: the persons, places, events, and things the respondents knew.

Formalistic Orientation. In educational research the most common way of describing complex things is to analyze them into their constituent parts and to summarize quantitatively the properties or variables common across a sample of these things. Understanding of particulars is expected to come by reference to populations which in turn are understood inferentially by a study of sampled cases. In order to make these inductive and deductive leaps, certain properties are identified as of particular relevance. The property is measured for each case. Inferential statistics are used as the basis for understanding the "general" situation. The description of complex things necessarily is limited to those things that can be expressed in terms of relationships among properties.

To describe one aspect of science teaching we might have identified the teacher and the textbook as two important parts. A property of classroom recitation might have been the frequency of teacher requests that a question be answered by reading it directly from the text. The actual frequency of this occurance would have been small, but it did turn out to be much larger than our expectation. Had we anticipated it and made such a count, we would have had a formalistic way of presenting that one issue. As it was, toward the end of our fieldwork we realized that such questioning was more common than we expected, and noted our common recollections across field sites. As it happened, then, it was a naturalistic rather than formalistic finding, though it could have been either.

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*Peter McHugh, Defining the Situation, (New York: Bobbs-Merrill Co., 1968) p. 9.

In CSSE we supported our naturalistic inquiries by collecting some standardized data and by classifying typical situations. We expected to do more than we did. We ended up without the quantitative summaries of the properties of science instruction that other proposers answering the RFP would have featured. What we did was to use the naturalistic orientation to identify the issues of teaching and learning, then to use the more formalistic questionnaire to get additional information. Thus we have many statements about the frequency of viewpoints, and relatively few enumerations of actual events.*

Upon receipt of first drafts of case studies, we debriefed ourselves in a naturalistic way, trying to exercise the discipline of the historian, ethnographer, and archeologist, searching for confirmation and disconfirmation in the experience we had encountered, and preparing a report based on generalizations drawn as much from recollection and intuition as from the formal records we kept.

CONSTRAINTS

Some of the framework for this study was set by the constraints of contract research in a real world situation. As indicated before, the National Science Foundation imposed certain requirements, such as the number of sites and representativeness of the sites. The schools, the research community, the calendar and our budget imposed certain other constraints.

The constraints that we were working under are discussed throughout this chapter as a part of the methodological context. We have presented them both as specific to each part of our methods sections and indicated how they shaped or changed our research design. The constraints are not unknown to many other researchers and are not mutually exclusive of each other. Time, budget and the state of social science methodology in general and a multiple case study project in particular are discussed.

The greatest constraint was time. We had a long eighteen months to do the work, to get answers needed much sooner, but still we had too little time. We did not have time to integrate into our thinking hundreds of suggestions, writings and research results that we came upon. The administrative burden took more time than it should have. We needed more time to write up the case studies and to assimilate the findings. Perhaps we should have confined our field observations to a single semester--but then we might have missed the reality of year-based schooling and we would not have had Lou Smith, Jacquie Hill-Burnett, Rudy Serrano, Dan Stufflebeam and Jim Sanders working on the project. The CEIS and OMB clearance procedures and NSF final review took too much time, even though those people were extremely cooperative--and our own clearance procedure for maintaining anonymity took too long, even though we ran into no problems. If we had had more time, we probably still would have wanted more time.

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*We were aware that some readers will dismiss as invalid any summary that is not based on objective measurement and impersonal analysis. The validation of our assimilation findings does not depend primarily on formalistic analysis. Within our case study chapters we present innumerable confirmatory items and the most contrary evidence we could find. Our methods are not immediately replicable in the sense that our fieldwork has been explicated so that another researcher could take exactly the same steps. But the study is eminently replicable in that our constructs are common and public, not steeped in special abstract or technical meaning. They are open to verification or repudiation by anyone. Other data such as ours are accessible. If we have failed to recognize a mass of disconfirming evidence, we are confident that our professional colleagues and others will bring it to attention--instance by instance perhaps--to discredit or qualify our findings.

As with any study, and even with a generous funding here, money was a constraint. The original budget was for $256,000 for an eighteen-month period. To add the Columbus site we were awarded an additional $26,000 and to improve the survey operations we obtained $10,000 and two months more study time. A rough breakdown of institutional allocations showed:

	Proposed	Actual
Professional salaries	$103,000	$132,000
Travel, lodging	52,000	41,000
Office, computer, printing	44,000	49,000
Indirect costs	57,000	72,000
Total	$256,000	$294,000

A more functional breakdown of actual expenses was estimated to be:

Field observations	$130,000
Site visits, coordination	40,000
Survey	30,000
Project administration	22,000
Indirect costs	72,000
	$294,000

Although more volunteer labor became available than expected, allocations of funds and other resources were essentially as planned.

Had more money been available we would have been able to pay observers for analysis and writing time and for additional time on site. Additional funding would probably not have availed us a more competent staff, nor inclined our observers more to the standardized techniques some critics wanted. In retrospect we realize we should have increased the size of our survey respondent groups (rather than going for additional groups, as we did) and we might have done that better had we had more money.

At the outset it was apparent that there are but few researchers experienced in field observation in schools, particularly regarding pedagogical and curricular issues. This was a constraint, but we accommodated the design to it, and got such people assigned to almost all our sites. We could have been disrupted by weather, or by dissension at headquarters, or by withdrawal of school cooperation, but we were not. The only constraint we were continually sensitive to was time.

Phases of the Project

CASE STUDIES

We undertook these case studies to provide an empathetic view of science education in a small number of schools--a view especially seen by the persons who spend their time there. If for example, the work is sometimes seen to be more difficult or less difficult because of what "outsiders" do (outsiders such as citizens, university projects, government agencies) we wanted to document that. The final portrayal was not expected to be what is typical for the country, but a guide to issues that are widespread. Readers may see their local situation in a new light, policy setters may see new implications of their policies, as they read these case studies.

Site Selection. Ten sites were selected at which to do Case Studies in Science Education. An eleventh site was added when NSF personnel became interested in an opportunity to study science education within a context of crisis, a heating fuel shortage during late winter, 1977.* We wanted to select a manageable group of cases that would illustrate the diversity of the total group, yet show the need to examine the complex nature of science education in each site.

Five sites were chosen within driving distance of where prospective field observers were doing other work. (We believed that qualified field observers are rare and difficult to hire: getting experienced educational field researchers to do the case studies was of high importance to us.) Within this driving range, the five school clusters, and the other five school clusters nationally, were chosen to give us a balance in geographic location, type of community (urban, suburban, middle-sized city, or rural community), curricular orientation (innovative, traditional) and reputation of the science curriculum.

The RFP had called for a well conceived sampling plan. Many proposers and reviewers interpreted this to require a stratified random sample. We would have preferred randomized selection if it would somehow allow us the balance just mentioned and an effective observer corps. There was no way of identifying the above characteristics for all schools in the population. We could have drawn a sample, stratified for geography and type of community, then checked out each new selection to see if it fit our definition of balance, replacing selections until the balance was attained. Even so, this sample would have caused us to lose four or five of our best field observers. We had to choose between a more robust site sample or a more robust team of observers. We chose the latter.

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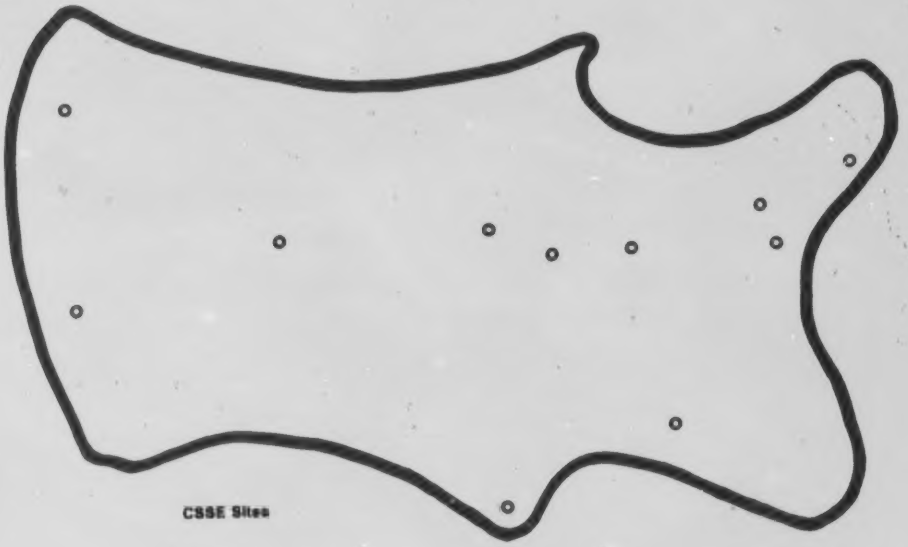
*Methodology of Case Study in Columbus. The case study authored by Jim Sanders and Dan Stufflebeam was researched independently. It represented an opportunity to study science education within a context of crisis--a school district crisis recognized by community and nation. Intensive efforts were made to gather appropriate information utilizing the following: observations; interviews; newspaper, Nielsen, and Arbitron surveys; television ratings; random sampling of groups of teachers, students, and parents; and hearings with teachers who taught over television.

The data collection took place during February 1977, when the schools were closed and "School Without Schools" was conducted. The observations, interviews and surveys were continued for a week after the school reopened March 7, 1977. Familiarity with the site was a factor for Stufflebeam who once directed The Evaluation Center at the Ohio State University and continued to have ties with the Columbus public school system. Unlike our other sites this one could not be granted anonymity in our reports because of the uniqueness and publicity of the emergency effort.

Access to the sites was an important consideration in site selection, but we did not turn down any possibility because access appeared difficult or unattractive. Only one potential site (Grand Rapids, Michigan) refused our request. In retrospect, we realized we might have biased the sample somewhat by thinking of (and later selecting), for a rural community in the South, a district whose superintendent we already knew. In some districts having multiple schools we saw that district officials were steering us toward or away from a particular school. Sometimes they persuaded us that their reasons were good. Sometimes we were able to persist with our rationale for a particular school. We completed the selection of school clusters with the conviction that we had gained access to a suitably balanced sample, free as one could expect a sample of ten to be free of misrepresentative characteristics.

An overview of the geographic location of our sites is shown on the map below.* It is obvious that the locations were not representative of all the country. We were pleased to get coverage of school situations in the newly envigorated Sun Belt and in the old inner cities of the North as well as schools East and West.** While the eleven sites possibly were not representative of the schools of the nation in certain ways, the key issues in these sites were found in the national survey issues in many school systems.



CSSE Sites

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*While showing the regional location of the sites for Case Studies in Science Education the exact locations have been disguised to maintain anonymity.

**An economic description of the sites is included on page C:16.

While negotiating with the school district for access we indicated which high school or which kind of high school we needed for our sample. After identifying that particular high school we selected some of its feeder schools (junior high schools and elementary schools) to complete the makeup of a site's "school cluster." The original plan was to study all the feeder schools but most field observers found it overly demanding of time to study more than 2 or 3. In more ways than one, greater consideration was given to secondary schools.

Proportionate populations in the selected school clusters were different, of course, from the district population figures presented on page C:13. However, due to concern that minority population not be ignored, minorities may be seen to be overly numerous in the schools in which we worked.

In addition to allowance for ethnic and socio-economic diversity was a concern that the eleven sites would have a balance of curricular orientation--traditional or innovative--and differing reputations for science programming. These criteria were considered casually, checked out by asking around, both in and outside the districts, and these reputational definitions fell roughly into the following description.

Six sites were considered to have rather traditional curricula and four sites, more innovative curricula. Of the former, four had no particular science reputation and two had a good science reputation. Schools with innovative curriculum were located in two districts with good science reputations, and two districts with no particular science reputations. We did not feel the definitions rigorous enough to justify formal comparisons.

It is obvious that the characteristics of the school clusters in this selection were not perfectly blocked; as they would not be in any selection of eleven sites. The important goal here was to get broad and somewhat balanced representation of school situations.

Two "trial sites" were very important to the CSSE project. One is a small rural setting in central Illinois, the other a large upper-Midwestern city marked by ethnic neighborhoods and the demands of implementing a court-ordered school desegregation plan. We functioned in both places throughout 1976-77.

In October 1976, we conducted a trial version of the forthcoming site visits in Arcola, Illinois. Students, faculty, administrators, and townspeople reacted to scenarios and to questions raised during interviews. Our early sensitivity to issues posed by the "Back to Basics" movement was reinforced by their responses. Also in October, the CSSE site-coordinator spent a week in Milwaukee reviewing documents made available by city administrators and interviewing subject-matter supervisors, resource teachers, and representatives of the "Committee of 100," which fashioned the desegregation plan. The work in Milwaukee provided a fine opportunity to examine both the influence of racial matters in school-community affairs and the impact of pluralism upon educational policy and programs.

Respondents in each trial site later critiqued instruments developed for use in the CSSE survey.

Site Description. The eleven sites studied were diverse. Size of a school system, population characteristics, and funding sources, are descriptive socio-economic statistics that usually come to mind when discussing a school district.* As depicted in Table 1, our sites included districts with enrollments of from 400 to 131,000 students. All but two districts were experiencing declining enrollments since the national high point of enrollment in 1970-71.

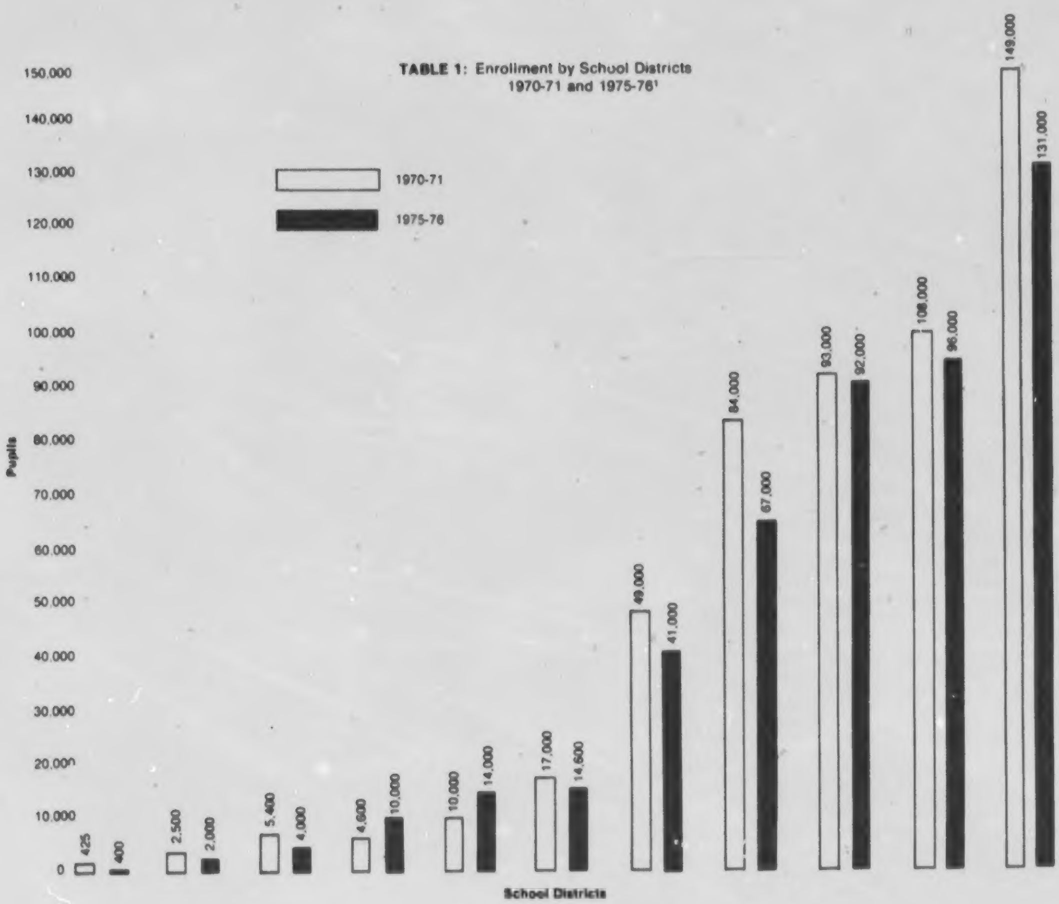

TABLE 1: Enrollment by School Districts 1970-71 and 1975-76[1]

[1] National Center for Educational Statistics. *Educational Directory: Public School System* 1970-71, 1975-76

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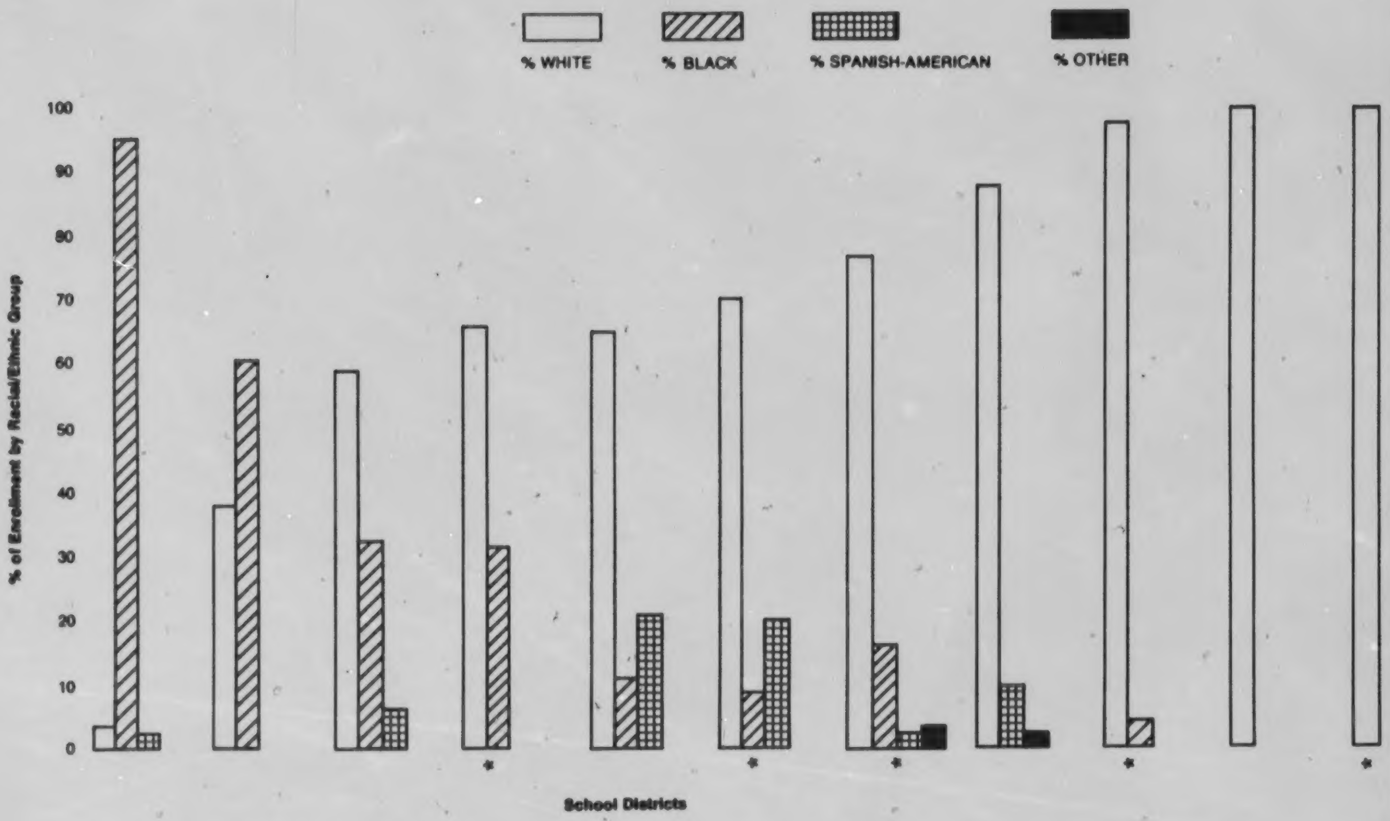
*Demographic information that was obtained from public documents or Chief State School Officers is presented here with concern for the confidentiality of the site.

TABLE 2: % Racial/Ethnic Group Enrollment by School District 1972[1]



[1] U.S. Department of Health, Education and Welfare, Office of Civil Rights *Directory of Public Elementary and Secondary Schools in Selected Districts*. Enrollments and staff by racial/ethnic group, 1972, 1976.

*1975-76 Chief State School Officer with permission of participating school districts.

Almost half (five out of eleven) of the districts reported minority enrollments between 23% and 40% with two more school districts reporting minority enrollments of about 2% and 11% respectively. The extreme cases were two school districts with minority enrollments as more than half of their student population and two school districts with no minorities or so few as to be unreported.*

As can be seen in Table 2 eight sites enrolled Black students and six sites enrolled Spanish American minorities. In two of these sites the Spanish Americans made up two-thirds of the minority enrollment and in a third site were almost all of the minority enrollment.

As is common nationally, the minority staffing of the school districts in our case studies was consistently lower than the percentage of minority students enrolled. Two school systems had about 50% or more of their staff as minorities and two school systems had none or too few to be reported. The majority (seven) of the districts employed between ½ of 1% and 15% minorities on their faculties.**

The type of city and source of funding were also diversified. Nine districts received between 33% and 70% of their revenue from state and federal sources. The extreme cases were the rural southern community who received 92% of its funds from state and federal sources, and the suburban midwestern site which was least heavily supported with only 9% of its funds from the same sources (see Table 3). These same two sites were also the extremes in expenditures per pupil. The rural site was spending less than $1,000 per pupil*** and the suburban site was spending more than $2,000 per pupil.****

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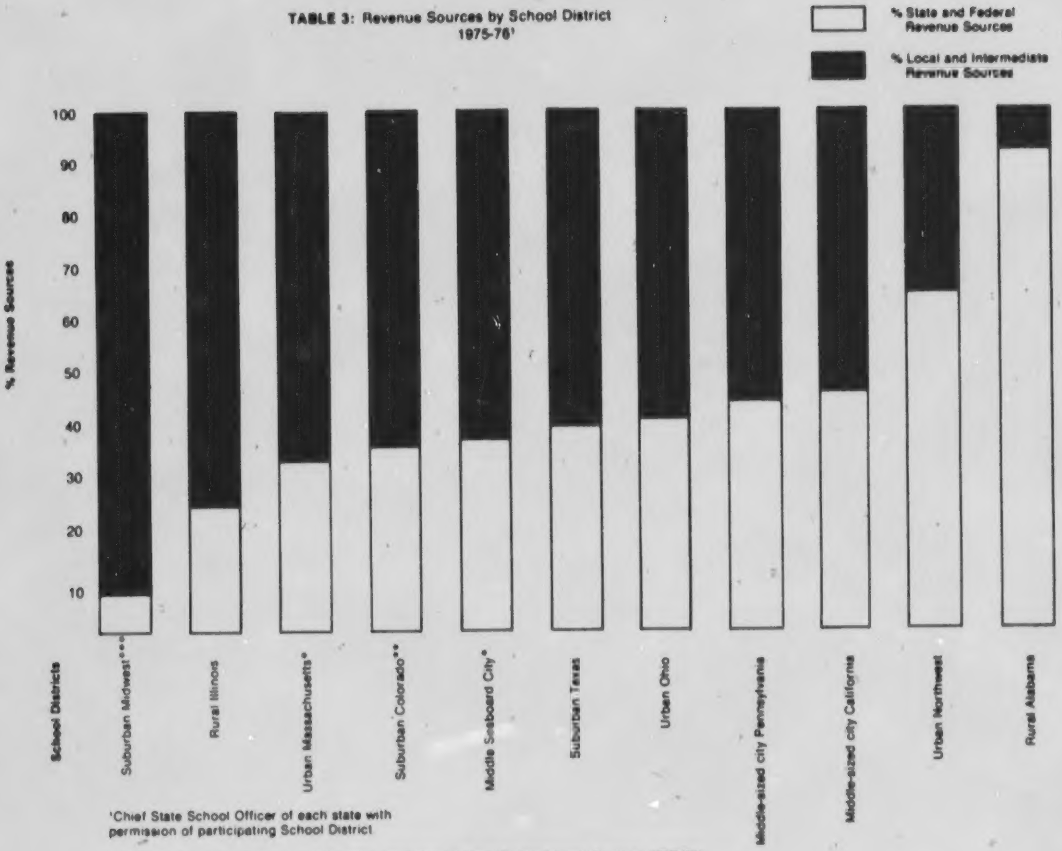
*There are no minorities at one site. (Chief State School Officer) And only 2% of the total population is reported as of minority composition at the other site. (1970 Census of Population, vol. 1, p. T:27, Table 39)

**U. S. Department of Health, Education and Welfare, Office for Civil Rights, Directory of Public Elementary and Secondary Schools in Selected Districts: Enrollments and Staff by Racial/Ethic Group (Washington, D. C.: U. S. Government Printing Office).

***Chief State School Officer with permission from participating school district.

****U. S. Department of Health, Education and Welfare, National Center for Educational Statistics, Statistics of Local Public School Systems, Finance (Washington, D. C.: U. S. Government Printing Office).

TABLE 3: Revenue Sources by School District
1975-76¹



¹Chief State School Officer of each state with permission of participating School District

* National Center for Educational Statistics, Statistics of Local Public School Systems 1972-73*
1970-71**
1969-70***

Field Observation

At least for this project, no one method of field observation was seen as the "right" method of field observation. Methods were expected to change to fit the situation. Each field observer was expected to rely on methods which worked best for him or her.

We thought there would be more methods than there were. We expected some to use structured observation schedules, others to pore over the district's own achievement test results, still others to arrange some simulated decision situations. But time was short and things happened fast. Most observers were doing what was simplest and more direct, watching and asking questions.

According to the RFP the observations were to be made by site visit teams.* The CSSE design called for observation by participant (or ethnographic) observers, as well as by site visit teams. The field observer took the role of "participant, as a visitor," The observers observed, and as visitors, participated in the ongoing events of the system. They reported their obvious but not uncommon presence as researchers, carrying notebook or recorder down the hall and into meeting rooms.

Various degrees of obtrusiveness were noted by case study authors. We liked to think they were unobtrusive on most occasions. Rob Walker made note of the interest in him as a "foreigner." On occasion of course it was the observer observed.

Recordings. We originally planned to record science teaching and learning both in the conventional scaled-property language of the psychometrician and the incident-narrative language of the anthropologist. As it turned out, our case studies yielded little of the former, almost entirely the latter.

We wanted to make some simple aggregate-data statements about the classroom at various sites, including some rough indications of the modernity of the room, the text-boundedness of the pedagogy, and the frequency of references to "what science means." We thought we might find common factors or categories that would help us typologize the classrooms and their teachers.

Prior to the August orientation session we developed a checklist. A copy of the final revision is shown on the following page.

We devised this 8 1/2 x 11 checksheet that could be completed by the observer in less than three minutes. We left space on the sheet for the observer's reminders of what specially should be looked for on that occasion, and for notes about lesson, classroom activities, and science education issues encountered. Wanting a sheet that would raise few apprehensions and stir few curiosities, we tried to make it a blank-looking page.

Each observer was asked to make a minimum of ten classroom observations a week, and to turn in a completed sheet on each. We had hoped that this task would not interfere with the individual observer's normal observing activities. We counted on a minimum of 750 completed sheets, which even with the huge mix of classrooms, would give us some nice input for statistical analysis.

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*Has the RFP design been followed more closely the study would probably have been completed with a report something like, Office of Rural Development, Getting Human Services to Rural People (Department of Health, Education, and Welfare, 1976).

C:18

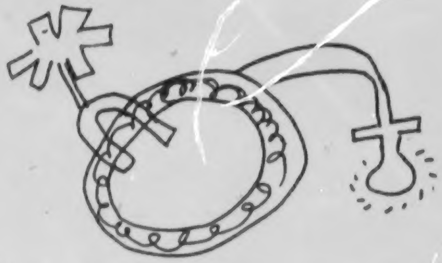
Observer: JAE School Code: LA Date: 10/76 Time: 2:00 To: 2:30
Teacher Code: MM Subject Matter Code: Scien Grade: 1&2 Time of write-up: 7:10 same day 4/3
No. students: 19 Teacher M [✓ F] [✓ 25] 35 50 65 experienced: L - [✓ -] H directive: L - [✓ -] H

SYNOPSIS OF LESSON, ACTIVITIES

Filmstrip with sound from a power company explaining the evolution of electric power with simulation model consisting of steam kettle, windmill, axel, rotating horse shoe magnet in inside a coil -- a flattened helix in a squirrel treadmill hooked to a burning 120 v light bulb, — shots of cave people, candles, fires, Ben Franklin's kite with key being struck by lightening etc.

SCIENCE EDUCATION ISSUES

Teacher wants to know if the apparatus in the film strip would really work. Observer said, "no" but something like it might



*One boy talked with other observer about a university most of the time

DESCRIPTION OF ROOM
modern - antiquatd [✓ m] - - a
mobile - fixd eqpmt [✓ m] - - f
open - regulated .. [✓ o] - - r
formal - casual ... f [✓ -] - c
active - still .... a - [✓ -] s
a learning place .. N - [✓ -] Y
a science place ... [✓ N] - - Y
a library place ... [✓ N] - - Y
a competition place N [✓ -] - Y

PEDAGOGY
text orientation . N - [✓ -] Y
test orientation . N [✓ -] - Y
experience based . N - [✓ -] Y
objectives based . N - [✓ -] Y
problem oriented . N - [✓ -] Y
operations,drill . [✓ N] - - Y
rules, examples .. [✓ N] - - Y
integrated subj m N [✓ -] - Y
diversions .... N - [✓ -] Y *

TEACHER AIM
didactic ... N - - [✓ Y]
heuristic .. N [✓ -] - Y
philetic ... N - [✓ -] Y
KNOWLEDGE USE
replicative N - [✓ -] Y
associative N - [✓ -] Y
applicative N - [✓ -] Y
interpretive N - [✓ -] Y

REFERENCE MADE TO:
meaning of science .. [✓ 0] - - M
roles of scientists . [✓ 0] - - M
sci vs. technology .. 0 [✓ -] - M
scientific methods .. 0 [✓ -] - M
sci as value-free ... [✓ 0] - - M
community, national . 0 - [✓ -] M
politics, government [✓ 0] - - M
ethics,morality,relig [✓ 0] - - M
ecology, environment [✓ 0] - - M

REFERENCE MADE TO:
courses yet to come . [✓ 0] - - M
sci clubs,fairs,etc. [✓ 0] - - M
rdg,math skills needs [✓ 0] - - M
school budget .... [✓ 0] - - M
TIME ALLOCATION
lesson .... 20 [illegible]
other education .... 5 [illegible]
admin, other non-educ .5 [illegible]

But one observer said that it was contrary to his field-method to do any writing during his first months of observation. Another said that the scaled properties we were asking for were inimical to his frame of reference for classrooms and were likely to be distracting. He tried a few and asked to be excused. Another observer did a few, then decided with only four weeks available, classroom observation would reveal circumstances and issues too slowly. He shifted almost entirely to an interview approach. The other two fall semester observers went about the business of completing the scaling requested; but when it became apparent that the others were not going to provide these data, we made it optional, and they too stopped. We thought that we might be able to pick up some of these data in the national survey, but downgraded that information there too, and ended up without any property-scaled descriptions of the classrooms at our eleven sites.

Thus we presented to many a reader a major disappointment. It seemed important to them, even though we were working with a small number of districts, that we should at least give a careful coding to the instructional activities we found there. We chose instead to insist upon attention to our list of science education issues, foreshadowed and evolving. Wanting not to lose any of our observers, or their enthusiasm for the job, we did not insist on the use of the checklist.

Only later did we realize this to be a major choice point in our design. In so doing we committed ourselves largely to an instance-and-issue orientation in the case studies. But the choice point was earlier still. At the time we selected the first of our social scientists we apparently had unconsciously foregone the standardized checklist approach, for few of them were interested in having this side of descriptive work covered too. Of course even though our observers were rather agreed on this de-emphasis on statistical description, they were different in other ways of describing the field situations.

Techniques of Description. We found an interesting contrast in techniques of description within the case studies. In some, comparisons were made between a school's past history and its current situation in terms of population mix, curricular emphasis, or relationship to the outside world. Comparisons were made between the particular school site in which a field observer was working and past school sites with which he/she was familiar. More abstract themes were presented by some observers, leading to discussion of theory of educational achievement, learning theory, or competition and social interaction theory. Pictures and quotes from teachers and students were used as explicit examples of what the observer found. Literature was introduced as a means of inviting the reader to react to the field observer's analysis. Some examples are shown below.

For instance a type of comparison used by Rob Walker in the South, Lou Smith in the Midwest and Mary Lee Smith in the West was that of historical comparison. Reference to the past was used to structure description (p 2:1):

> The study of science education programs at a single site, FALL RIVER, Colorado, exposed bits of the history of the field. In this archeological dig can be found remnants of each era: the pre-Sputnik traditional disciplinary science--still used in some classes; the textbooks, equipment and institute-trained teachers left by the first two generations of National Science Foundation activity; the enrollment decline and disillusionment with science coincident with the romantic rebellion; the enrollment resurgence that has come with the new pragmatism; the recent popularization of the ecology movement. All of these historical eras have had effects at FALL RIVER, and all left some relic. In each case the impact was deflected or defused in some way, as if an alien culture had attacked an older one, entered its territory, but gradually lost its language and separate identity, absorbed into the older one.

Another type of comparison writers used was reference to previous conceptualization, especially how it was altered upon entering the site and engaging in participant observation (p 5:2-3):

> As I turned right on Evergreen Street and started down the hill, I noticed a sprawling yellow brick building outlined with white trim. A red, white, and blue Patriot (the school mascot?) painted on a single chimney stood guard over the school. A modern two story building, about a dozen years old, was nestled in a large grass-covered valley. A raft of tennis courts was flanked by football and baseball fields, and several adults were jogging on a path that circled the gridiron. Several temporary buildings, painted a dull orange, were behind the school and a large parking lot was filled with brightly colored cars. The whole setting was surrounded by an ampitheatre of green pine trees, yellow maple leafs, and manicured lawns leading from the street to single dwelling homes. For a moment, I thought I had escaped the city boundary and had mistakenly arrived at one of the surrounding suburbs. But no, the silver block letters to the right of the white pillared entrance clearly spelled out: HARDY HIGH SCHOOL 1965. As I pulled into one of four parking spaces marked VISITOR, I thought how far wrong my expectations for the appearance of the school had been. I locked my car doors and went through the main entrance. The halls were filled with students, talking and walking, and I was struck by how similar the picture was to the Milwaukee suburban school I left in 1963. I entered a door marked OFFICE and introduced myself. They were expecting me.

Another comparative technique was the use of the stranger to a situation. The stranger notices phenomena that the participants have long ago accepted and no longer consciously considers. For instance, Rob Walker stated (p 11:2):

> It's an interesting thing about the school that once inside you lose much sense of what lies outside. It's one of those things that is so obvious to all the teachers that they have long since ceased to question it.

Ethnographers often rely on theoretical orientation. In Lou Smith's study he invited the reader to see how his attention was directed to theory. This technique of reaching for a more general abstract theme runs throughout Lou Smith's study. He described an incident, then stated (p 3:22):

> I think what I'm reaching for is a set of reasonably simple hypotheses (mechanisms) on the antecedents, nature and conception of school learning with particular emphasis on explaining the high achievement levels of upper middle class kids, e.g., the two grade levels and/or 1+ SD above the mean on test scores.

Another interesting manner of pursuing a thought or explanation can been seen in Lou Smith's interpretive asides (p 3:13):

> As they talked it seemed to come out that different schools had different things going for them (as I'd heard previously). For example--one has a big outdoor education program, second grade and up, overnight camping, etc. Another is trying out some of the new CEMREL math materials in the primary grades, and so forth.
>
> ("Obs - All this suggests aspects of the old elementary principals competition, indentity, and place in the sun as a major issue in the dynamics of a district and efforts in curriculum, teaching, parents, etc.)

Explicit examples of what the observer heard or saw in the class were used extensively by Peshkin, Serrano, Denny, Walker, Hill-Burnett and both Smiths. Entire tests were included by Alan Peshkin because he "believes tests are particularly indicative of those things a teacher most values, though not exclusively, their students knowing." Pictures were used by Rudy Serrano, an advocate of visual anthropology. But Terry Denny said (1:1):

> Seeing may be believing, but I need more. I never see the picture worth a thousand words. It occurs to me that a very few words can represent a thousand pictures; can represent unobservable feelings; can reveal tomorrow's hopes and yesterday's fears which shape today's actions. My story is largely teachers' words.

All of these field observers made extensive use of direct teacher-student dialogue. This dialogue often included description of the context in which the interaction took place.

Reference to literature--poems, stories, plays and books--was yet another technique. Terry Denny used poems. Wayne Welch used a book, Working, by Studs Terkel, to describe a style of writing. Rob Walker used Steinbeck to suggest caution in interpretation. Lou Smith utilized educational literature to tell the reader his interpretation of a specific classroom situation (p 3:17):

> (Obs - Through all this I'm reminded of Brueckner's Diagnostic Tests in Arithmetic. The system seems a logical outgrowth of that point of view. Need to look at old NSSE Yearbook from 1934 (?) and the Bond and Brueckner Diagnosis and Treatment of Learning Difficulties. Need to check manuals. Seems like a teaching and organizational system (aides, storage and LRC) building upon that. Need to look at IPI manuals and reference literature.)
>
> I go through Placement Test C. There are 2-3 pages on each area. It does look like Brueckner writ large.

At another point Lou Smith used writings on philosophy of history to make an analysis about what he saw in ALTE (p 3:109):

> The historical perspective can lead also to a fundamental reworking of one's approach to the very nature of knowledge. Reading Toulmin's and Goodfield's triad of books on the history of science, Architecture of Matter, Fabric of the Heavens, and expecially The Discovery of Time in anticipation of the project was both provocative and unsettling in terms of specific ideas and conceptions in "Science" and also in the investigator's own conceptions of social science as it related to CSSE. In the preface to a later book Toulmin (1971) expressed it this way.
>
> > *The central thesis of the present volume . . . can be summed up in a single, deeply held conviction: that, in science and philosophy alike, an exclusive preoccupation with logical systematicity has been destructive of both historical understanding and rational criticism. Men demonstrate their rationality, not by ordering their concepts and beliefs in tidy formal structurals, but by their preparedness to respond to novel situations with open minds--acknowledging the shortcomings of their former procedures and moving beyond them. Here again, the key notions are "adaption" and "demand" rather than "form" and "validity" . . . The philosophical agenda proposed here sets aside all such assumptions in favor of patterns of analysis which are at once more historical, more empirical and more pragmatic. . (1971, pp vii and viii)*

> His point of view is a large agenda, indeed. It leaves one feeling more than a bit presumptuous.
>
> The zoning of parts of ALTE into 1 1/2-3 acre lots sixty years ago is a chronicled fact. The interpretations that this led to "executive city" or to the current upper middle class quality of the community and the emphasis on educational excellence is overly simple and open to question. The relevance of this thought to policy groups such as NSF or NIE and to more local immediate "change agents" however, does seem very great.

One reason for using an outside reference is to assist the reader to make his/her own comparisons. The literature is utilized as a backdrop for both the field observer and the reader to react to description in the case study. It should help explain how the researcher made his/her analysis.

Judgment During Observation. Field observers doing case studies are faced with a dilemma as to the degree to which their field notes should be composed of judgment-suspended observations. According to the "code" ethnographers are said to follow, raw observations should be emphasized because they permit the observer and others to go over the data with alternative questions, potential interpretations, and different frames of reference.

It is apparent however that the judgment-suspended mode of observation is itself a frame of reference, increasing the number of certain entries in the log, decreasing others. A transformation from "normal" observation occurs. Readers are denied some of the most direct vicarious experience. It may be said that they are reading a report of "laundered" data, data that no one sees directly. Their normal style of observing, of course, is a more judgmental style.

David Bohm made the point that, for the purposes of science, perception and communication should be--as nearly as possible--one and the same thing. This identity would, it is presumed, argue against judgment-suspended observations, for the scientist, as the layman, is more accustomed to interpretation-laden observations than interpretation-free observations.*

Selection of Field Observers

Each observer's report is essentially a description of the behavior of science education in its habitat. It includes a description of the context in which science education is conceived. It is conventionally "objective" in the sense that it is for the most part a shared perception--one that the researcher, site visitors and the participants recognized in common. It is "subjective" in that it was the field observer who decided which issues were pressing and which relevant to NSF needs. More agreement, of course, was found on what it was that was happening than on what was worth further study. At the outset, we wanted to select field observers who had experience with both the objective and subjective responsibilities.

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*David Bohm, "Science as Perception-Communication," in The Structure of Scientific Theories, ed. F. Suppe (Urbana: University of Illinois Press, 1974).

The field observers were to be the main CSSE data gatherers. They were to operate with a great deal of freedom to discover those issues important to people at the site. They were to be observers who had demonstrated their ability to produce insightful field studies and, if possible, already to have had some familiarity with the site. The selection of field observers was made with the intent of capitalizing on the use of experienced,* highly competent researchers who would broaden the view and minimize the subordination of the perspective to any one theoretical or methodological view. The need for inter-disciplinary purviews was argued by Szwed:**

> The training of urban ethnographers requires a reach across disciplines and departmental politics that few universities now seem able to accommodate. A well-trained student needs to combine the knowledge of a half-dozen fields with the skills of the classical anthropologists and those of the best journalists and reformer-investigators (such as Beatrice Webb, Henry Mayhew and Jack London).

He pointed out that,

> students with backgrounds in linguistics, folklore, history, English, sociology and American civilization as well as anthropology have studied bars, schoolrooms, geriatric nursing centers, apartment buildings, playgrounds and the streets . . . to build up a portrait of contemporary American life.

However, according to Szwed:

> it still remains to show how this research can best be used and interpreted by those who choose to use it.

We selected*** field observers with backgrounds in the fields of anthropology, sociology, educational psychology and various sub-specializations. Individuals with the "half dozen fields" experience and training suggested by Szwed, are not, to our knowledge, yet in supply. So our interdisciplinary and interuniversity needs were addressed by utilizing many people with different skills and training and hopefully with a high regard, interest and commitment to produce an interdisciplinary framework for the CSSE project.

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*It was with some dismay that we first realized that we were designing the study without lending to the support--financially and experientially--of graduate students. Later we found it possible, actually necessary, to enlist several to assist with the assimilation and final report preparations.

**John F. Szwed, "Anthropology Now Looks to the Cities for Field Trips," New York Times, 22 February 1976.

***If we had had complete freedom to design this study we would have made observations in perhaps six field sites for a year. Field observers of the talent we wanted (and later obtained) then would have cost us some $300,000 just for salaries, including university overhead. With $250,000 available for all expenses and a RFP requirement for at least 10 sites, we had to shorten the observation period. We budgeted about $100,000 for observer salaries, including overhead, and went out to see what that would buy. The people we wanted would work for an average of about $1250 per week, counting overhead. We picked out four sites (ALTE, FALL RIVER, GREATER BOSTON, and BRT) and budgeted for 12 weeks there. We budgeted for 4 weeks study at the remaining places. With these funds and good luck we were able to get all the longer observations and four of the shorter ones staffed with the field researchers we most wanted. The remaining two sites were staffed from within the CSSE headquarters team (by Denny and Hoke). Even with this large budget for field observer salaries these people were underpaid in that most remained at the sites longer than the minimum period and none were paid for the lengthy period of writing after observations were completed.

We assigned the original ten case studies to the following field-observers:

Terry Denny, University of Illinois; educational psychologist, specialist in evaluation of teaching materials; once a field survey researcher, grade school teacher; Ed.D. 1962.

Jacquetta Hill-Burnett, University of Illinois; urban anthropologist, researcher of intercultural education, author; once a science curriculum developer; Ph.D. 1964.

Gordon Hoke, University of Illinois; specialist in innovation and community-school relations; once a social sciences and gifted education teacher; Ph.D. 1965.

Alan Peshkin, University of Illinois; comparative education specialist, director of African Studies, rural school ethnographer, author; Ph.D. 1962.

Rodolfo Serrano, California State College at Bakersfield; anthropologist, bilingual/bicultural educator, author; once a physics teacher; Ph.D. 1972.

Louis Smith, Washington University of St. Louis; educational ethnographer, case study methodologist, evauation specialist, author; once a school psychologist; Ph.D. 1955.

Mary Lee Smith, University of Colorado; program evaluator, counseling psychologist, researcher on sex bias in counseling and psychotherpy, author; Ph.D. 1972.

Rob Walker, University of East Anglia; educational sociologist, field study specialist, author; once an inner-city math teacher, teacher educator.

Wayne Welch, University of Minnesota; science education researcher, educational psychologist; once a curriculum developer, physics teacher; Ph.D. 1966.

Although our case study researchers are referred to as ethnographers, as evaluation specialists, as sociologists, anthropologists, and comparative education specialists, the case studies were undertaken using the general methods of field observation.* Each of our field observers was asked to use his/her own techniques--as developed across years of academic training and personal experience.

Orientation sessions were held in August of 1976 for the fall observers and in January of 1977 for spring observers. A few of the fall observers were available to attend the second orientation session thus providing additional continuity. Background readings included the following:

1. CSSE proposal and statements
2. "Organizational Structure and Student Behavior in Secondary School," by Cusick, Martin, and Palonsky
3. "'Degrees of Freedom' and the Case Study," by Donald Campbell (p C:27)
4. "The First Probe," by Charles Brauner
5. An abbreviated version of "Eden Grange," Rob Walker's SAFARI case study

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*We found those best summarized for field work by: Leonard Schatzman and Anselm L. Strauss, Field Research: Strategies for a Natural Sociology (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1973).

Such a qualitative research enterprise as we planned depends on the researcher's ability to make himself/herself a sensitive research instrument, partly by becoming acquainted with the perspectives of those studied. He/she must operate in two worlds -- the world of the subjects or informants and the world of the research perspective.

A reader needs to know what the researcher's original points of view were. It sometimes helps to know:

> What was the researcher's role in the setting?
>
> What was his/her training and background?
>
> Whatwas his/her previous experience in the field?
>
> What were his/her theoretical orientations about relevant issues and personal feelings about topics discussed?

A few of these questions are answered in the biographies of the field observers and some within the introduction to the case studies themselves. For instance, Denny said (p 1:1):

> I am fascinated by what people do in schools and what schools do to people. My task as I saw it was to describe what people said and did about teaching and learning of science and mathematics from kindergarten through twelfth grade in the RIVER ACRES Independent School District, a suburban/rural setting in the Houston area. Not to evaluate it. Not to do anything about it. I once agonized over writing recommendations for schools I had evaluated or researched. Worse, I was nagged with the persisting question, "Was anything ever done? Tell me if anything was ever done." I now rarely write prescriptions for teachers. I went to Texas with no personal preference for self-contained classroom instruction, for open-space instruction or for homogeneous grouping of students. Moreoever, I am uncertain of the relative social importance of the school subjects as we commonly know them.
>
> It pleases me to write this story without the additional burden of formally judging the merit of the teachers and practice I observed. The fact that I was there and not you is of huge importance of course.

The personal involvement, how they felt personally toward people and events, can be found throughout the case studies. Louis Smith said:

> I'm amazed/struck by the seemingly flawless aspect of the system here. The aide has been with the program several years. She has no problem, works very rapidly, etc. At this end, the personnel, the facilities, the storage of materials, then plenitudes (nothing looks like it's even close to being out), the routines are all running smoothly. Need to look at other end.

The researcher went into the field as a sensitive instrument to gather information on science education and the context in which it is taught and learned. The case study reports belonged to those researchers; no editing was done of them other than what the field observers wanted.

Conceptual Structures

At each site the field observer was to observe the teaching of science, mathematics, and social science. Observers were acquainted with the CSSE list of potential issues, derived in part from the NSF RFP, but were relatively free to choose what persons and actions to observe. As a general rule of thumb it was expected that about half of the attention would be given to the physical sciences and a quarter to mathematics and a quarter to social sciences. (To be sure, it was expected that there would be a great many issues worthy of consideration that would be no more identified with one subject area than another.) The rule of thumb was not to deter probes of any educational or professional issues of local concern. The search for consistencies within the uniqueness of each site, each classroom, was stressed by Robert Stake:*

> One thing common to all authors and users of case studies is the search for a pattern. All researchers are interested in regularity, in consistency. Even in the most unique of persons, even in the most unique curricula, even in the most unique of bond-referendum campaigns, there are certain patterns.

Validity. Although we pursued the particularity of each site, for the NSF, generalization was the goal. We wanted to make these studies useful to people, not because we were interested in some particular place or even in some particular idea. We looked for a kind of generalizability based on deep understanding of phenomena which increases one's opportunity to recognize similarity and analogy. Each case study depends on this kind of generality. It depends on extending the reader's existing apprehension of experience through new vicarious experience. The general then is a very personal general. Previously Stake called it "naturalistic generalizability."** To be a good basis for comprehension or policy setting the generalizations should be based on valid observations.

We saw it essential to prepare as valid a presentation of science teaching as we could. But this did not mean to us, to make the most objective account we could. Objectivity often can be increased best by omitting elements that are subject to different interpretation. To do so is to risk omitting some of the most vital considerations.

All representations are couched in meaning: Numbers, photographs, words, whatever. Someone invented all these things for the purpose of sharing meanings. Some meanings of representations are widely shared. Everyone agrees that it is 3 (not 2 or 4) people in the room. To the extent they agree we say that the representation, here the numeral of enumeration, is "objective."

Some meaning is not widely shared. "The people here are fundamentally good people." The meaning is subject to different interpretations. Different observers and readers will differ as to the meaning of the words as well as to the claim that it pertains to these particular people. To the extent people will disagree as to the accuracy, meaning and the associated implications of the represenations, those representations are more "subjective."

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*Robert E. Stake, "Seeking Sweet Water: Case Study Methods in Educational Research" (Urbana, Ill.: Center for Instructional Research and Curriculum Evaluation, AERA Training Tape Cassette, forthcoming.)

**Robert E. Stake, "The Case Study Method in Social Inquiry," Educational Researcher 7 (February 1978): 5-8.

We would strive for objectivity, as long as it did not cause us to lose important meanings. There are many exceptions to the belief that the more objective representations are the useful. "There were 3 or 4 people there, all of them good people." Of the two representations in that sentence, one more objective and one more subjective, it is impossible to say out of context which is the more useful.

In seeking ways to make our CSSE representations useful we of course did try to minimize those biases of personal view and acculturation that contribute most to misperception and misunderstanding. These are subjective criteria, of course. We tried to recall or imagine how a representation can lead to confusion, neglect, or injury and finding none, to judge that representation as having avoided the worst forms of invalidity.

One of the primary ways of increasing validity is by triangulation.* The idea comes from sociology (and from navigation at sea). The technique is one of trying to arrive at the same meaning by at least three independent approaches. Naturally a finding that has been triangulated with several independent data-holdings is usually more credible than one that has not.

Triangulation somehow has come to have a divergent as well as a convergent connotation. To some people it means taking additional viewpoints in order to encounter the multiple realities of the situation. This aim was prominent in CSSE, but we used the term "triangulation" to mean converging to a focussed representation of any one viewpoint.

CSSE triangulation occurred both within and across case studies. The field observers sought out informants having different positions, roles, experience, attitudes, and goals in order to check the perceived constancy of a phenomenon. The observers themselves observed, interviewed, and analyzed documents. Their findings were reviewed by site visit teams, site coordinators, and on-site educators.** All provided additional views as well as confirmations or disconfirmations of particulars.

Writing each case study remained the responsibility of one person, the field observer. Independent observations were conveyed, particularly by site visitors, to CSSE headquarters. Many taped interviews were analyzed by a specialist in linguistics well experienced in science education research (Peg Steffensen). Survey data were added to the site visit and case study data. Triangulation occurred across CSSE sites as multiple researchers examined the issues manifest in data from multiple sources at the eleven sites and from the national sample.

What we can say with assurance is that what we report was there to be seen. The emphasized things were seen many times over. What we cannot say is that the things we report were the most important things to be seen or that we have interpreted them in the best way. Also, we cannot provide an index number that indicates the degree to which our findings are valid. That is a disadvantage of all naturalistic observation, but naturalistic observation reports have the great advantage that the readers can participate in the determination of validity, especially to the extent that the observations cover some matters that they are already familiar with.

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*For a discussion of triangulation see: Donald T. Campbell, "'Degrees of Freedom' and the Case Study," Comparative Political Studies 8 (July 1975): 179-191. The strategy was discussed more generally in D. T. Campbell and D. W. Fiske, "Convergent and Discriminant Validation by the Multitrait-Multimethod Matrix," Psychological Bulletin 56 (1959): 81-105.

**On site administrators in particular were used as reviewers of draft reports. Earlier they had been assured the privilege of review, to result in a statement of substantiation or refutation of the case study at their site. While all such reviews were to be read carefully, the final decision as to what to include in the case study report remained with the field observer. From our California site came the only major statement of refutation. A member of the district superintendent's staff sent a statement which is included in Booklet VII with the WESTERN CITY case study.

A case study is valid if it gives an accurate and useful representation of the case in a certain setting--with reference to certain research questions. Accuracy of observing and reporting is more than a matter of everyone seeing the same thing, for many observations cannot be made independent of the observer's point of view. The validity of a case study then is dependent on the observer's point of view, and its utility to a reader will be dependent on recognition of that point of view. To some this sounds hopelessly relativistic, but it is consistent with Lee Cronbach's 1971 definition of validity.*

This kind of validity pertains to the use that is made of the report. If the resulting comprehension or action is of a higher quality than it would have been without the report, then the report is to some extent valid.

Clearly we are not willing to claim that in order for a report to be valid the observations reported need to be those another observer would have reported. We would of course question the validity of the report if among those who were at the same scene, nobody saw what was reported. The report is not necessarily invalid, it just has not been validated.

To be validated a report needs to be confirmed through other observers, it needs to survive deliberate efforts to disconfirm it, and it needs to be credible. This latter is to acknowledge that previous experience can contribute something to the confirmation, and that it is validity "for use by persons" that we are most concerned about. If a report strains credulity, then it will need much more confirmation to attain a certain level of validity. If a report contains the highly expected, then we will spend less of our resources challenging it.

Validity should be considered less than complete if no effort has been made to disconfirm the observations, even if they have been confirmed.

During an extended visit to a complex site, only a small portion of happenings will be seen, and only a small portion of those seen will be reported. An important isolated event may occur. The idea of inter-observer reliability of reporting may be pretty nearly lost in such a situation but the idea of validity holds.

What is expected by readers is that the observer will look carefully and skeptically, striving to see more than is easily seen, looking for missing connections, moving to different viewpoints to see the same happenings; then doubting what has been seen, striving to see once again, being skeptical about what is being seen, seeking other interpretations of what is seen.

The question of validity of field observations and case studies will probably be debated for some time. In these studies we considered it our obligation to report what seemed to us to be of most importance, that which we could validate as well as that which we could not. We tried to indicate to the reader the effort we made to substantiate different findings and to share with the reader as much of the burden of deciding what weight to put on the presentation.

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*Lee J. Cronbach, "Test Validitation" in Educational Measurement, 2d ed., ed., Robert L. Thorndike (Washington, D. C.: The American Council on Education) 1971.

Salience of Topics. What an observer pays attention to and reports is partly a subjective choice, but subject also to disciplined experience. Not only are some questions previously indicated to be of greater importance, but the importance at the site of some topics is easily recognized. The case study worker makes the decision partly on what presumably will be useful to the audience. Experience helps make good presumptions.

Three principal questions initially guided the CSSE project.

1. "What is the status of precollege science teaching and learning today?"
2. "What are the conceptualizations of science and science teachers held by teachers and students?"
3. "What happenings in school and community are affecting the science curriculum?"

These questions are broad and provocative. And by honoring the educational and professional concerns of science teachers we did not entirely meet the expected attention to subject orientation. Some field observers found the state of science education so overwhelmingly influenced by state or federal laws, budgeting demands or enrollment declines that they elaborated on these contextual variations. For instance, lack of resources for science supplies in Alabama demanded sustained teacher resourcefulness. In our Eastern middle seaboard city, agencies acting as youth-advocates, acting to keep children in school, made it much more difficult for teachers to teach. At the same time the schools' immediate usefulness to these children was questioned by both the children and the teachers. And a small school with low enrollment in our Illinois site meant little student interaction in science and in fact less science than other places nearby.

In all sites there was pondering and even distress over what the issues were. Several of the field observers chose to organize at least part of their study around a conceptual structure or theme. For example, Terry Denny's study (RIVER ACRES) examined "education as preparation." Jacquie Hill-Burnett's study (ARCHIPOLIS) described opportunity to learn among the other "rights" of students. And Rob Walker organized his case study (PINE CITY) around the progress of desegregation efforts in an Alabama community.

We were asked why in the CSSE final report we gave high attention to "textbook teaching" and little attention to the preponderance of males in high school science departments. Both seemed equally true. The textbook issue was an early candidate for attention in the final report because it was mentioned several times by one field observer and because it struck the authors as relevant to the presumed interests and responsibilities of final report readers. The possible exclusion of women from science faculties did not come up as a possible major theme from any of the observers. When mentioned at all, it was not seen as something to be high among the presumed interests and responsibilities of readers. The textbook orientation was considered a tentative finding when perusal of the case study drafts indicated that it was a rather common circumstance. The finding was seen as departing somewhat from project staff expectations as to what would be happening in science classrooms; thus it became a more frequently mentioned theme. The field observers were polled to see if they had counter evidence to the findings; they reported none. From the beginning the "textbook teaching" topic was recognized as something several of the research team already had more than a passing interest in. The question of bias was considered and felt not to be elevating a non-issue to issue status.

So it appeared that the basis on which this and other topics of the final report were selected was partly a matter of each of the following:

a. commonness at the sites
b. relevance to questions raised in the RFP and proposal
c. interests of staff in the topic
d. departure from staff expectations as to what the science situation was
e. presumed usefulness to audiences of the final report.

Definition of Case Study

Each case study was organized around a somewhat different conceptual structure. That structure is tailored to the particular case. According to Louis Smith, the case study is mainly different from other educational research studies in that it is*:

> the study of a bounded system. The crux of the definition is some conception of unity or totality to that bounded system. . . . The key notion is that you've got some kind of entity, a case, and it has some kind of unity. Somebody perceives a part of that unity and wants to study some more of it.

Stake put the difference this way:

> So the principal difference between case studies and other research studies is that the case is made the focus of attention rather than the population. In most other studies, researchers search for an understanding that ignores the uniqueness of individual cases and generalizes beyond particular instances. They search for what is common, pervasive, and dependable.
>
> In the case study, there may be or may not be an ultimate interest in the generalizable. For the time being, the search is for an understanding of the particular case, in its idiosyncracy, in its complexity. Its uniqueness is not considered "error variance." Its uniqueness _is_ considered "a handle" for better understanding the way the case does or does not maintain equilibrium under environmental stress and strain.
>
> The principal difference is one of focus. It is not the experimentalists' focus on precise variation in a single criterion revealing the aggregated reactions of many cases to specific treatments. It is not the historian's concentration on the complex-mediated connections between antecedent and subsequent events. It is a focus on the happenings around a single actor (be it child or institution or enterprise), so as to understand that actor, that bounded system, in its habitat.
>
> So what is being studied is _the case_. The case is something deemed worthy of close watch. It has character, it has a totality, it has boundaries. It is not just an instance representable by a score; it is not only an entity which could be represented by an endless array of scores. It is a complex, dynamic system, something to be thought of as an existing entity, even when simple descriptions are being made of it. The case study tells a story about a bounded system.

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*Robert E. Stake, "Seeking Sweet Water: Case Study Methods in Educational Research" (Urbana, Ill.: Center for Instructional Research and Curriculum Evaluation, AERA Training Tape Cassette, forthcoming).

Our CSSE case studies were the products of field observers who observed, interviewed and analyzed. The authors selected a conceptual framework on which to lay out their case. The report was partly a product of their intensive academic training, partly a product of their socialization into a community setting and partly a product of their values. Most authors made reference to the possibility of another story at another time or by another person. It was recognized that there probably were many potential conceptual frameworks. That fact should not preclude the validity (discussed in this chapter elsewhere) of the current story. Each case presented had its boundaries--boundaries set by the authors in the sense that they wrote the story. However, others helped set the boundaries.

The people who set the CSSE boundaries were those who cared about the science programs. That included teachers at the scene, the NSF, and it included prospective readers of the case studies. Certain things belong to the case, according to their expectations--so the boundaries of the case were set partly by those people (anywhere) interested in the case.

We had to have boundaries. One cannot deal with the totality of anything. Some strong claims have been made for the case study as dealing with the "complete" story. Of course it does not do that. It is extravagant to claim that the case study tells the whole story. But it does deal with unity of the case, the unity of the experience, in ways other research methods do not.

That leaves us with a pretty loose but workable definition: that the case study is a study of a bounded system, emphasizing the unity and wholeness of that system, but confining the attention to those aspects that are relevant to the research problem at the time. The definition of case study does not indicate whether more formalistic or more naturalistic observations are to be made. We chose to make the CSSE observations naturalistic.

Arrangement With Schools

To facilitate the arrangements between the CSSE project staff and the administrators at participating schools, we formed what Gordon Hoke called a "temporary system."* It responded to demands stemming from the following activities:

1. Obtaining access to sites
2. Minimizing disruptions of school activities by CSSE observers
3. Expediting the gathering of field data by CSSE observers
4. Facilitating communication among
    a. the principal observer on site (the field observer)
    b. the coordinator (a University of Illinois faculty member)
    c. the local school liaison person (administrator or their surrogate)
    d. others
5. Preserving the anonymity desired by individuals and institutions
6. Facilitating a three-day visit by a four-person team to each site, and
7. Making the close-out arrangements

The person in charge of making the arrangements for CSSE was Gordon Hoke. Negotiations for access to the ten sites and CSSE staff behavior within them were guided by the writing and work of two distinguished ethnographic researchers, Roger Barker and Art Gallaher, Jr.

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*See p C:47, Project Management.

Primary and official contact was with the office of the superintendent of each district. Originally we had anticipated and hoped that a local science or math teacher would become a liaison person. However, in operational terms our liaison continued to be with administrators or their surrogates. Details of arrangement, of course, were in part made with the principals and the science, mathematics, and social science teachers at the participating schools. A written agreement was made known to the National Science Foundation and CEIS.

Possible Bias by Cooperation. Cooperation of administrators in school systems is necessary for a case study of the kind we wanted. By and large we found administrators and teachers quite ready to cooperate. A potential bias should be noted. Since matters were arranged through administrators we may have moved toward situations where there was little antagonism toward administrators, which might not be a general condition. It is possible that in sites where administrators are more beleaguered and on the defensive that the perception of the needs of science teaching and learning would be different. However since only one superintendent turned us down, the fault would have to be in the original list of sites.

Of course, the sites in which we worked were not totally free of administrative problems. There were some for example, in one district that required the replacement of a building principal (shortly after our site visitation terminated). In some schools morale was very low among the faculty--for a variety of reasons, e.g., lack of student motivation, lack of supplies or lack of administrative support. Several good, young teachers in a couple different places, planned to leave not just the system they were in--but leave the profession of teaching entirely.

Anonymity and Confidentiality

Our intrusions into the life of the school were carried out with concern. Not only disruption, but embarrassment and misrepresentation were constant possibilities. One protection rested in the anonymity of sites and persons. Our concern was expressed in CSSE Statement #4 (on the next page).

At the beginning it was presumed that--after clearing the reports with all persons possibly jeopardized--the actual names of cities and schools would be publicly revealed but personal anonymities would be preserved. The interpretation of case study data is usually improved, we believed, if the reader's knowledge of these places can be combined with the case study portrayals. At project finish, we realized that person by person clearance was too enormous a task, so site anonymity was preserved too.

CSSE STATEMENT NO. 4 Stake
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A case-study approach in educational research--even when the case is not a person or groups of persons--is likely to be personal. The concentrated study of teaching and learning, an intense examination of meanings and priorities, is likely to expose teachers, students, administrators, and others to unusual scrutiny. The personal dimensions of responses here are not going to be obscured by hundreds of others as they are in survey research.

All case-study research--and particularly that sponsored by governments--has a special obligation to provide legal and ethical protections.

Even for persons observing the highest standards of moral, ethical, and legal conduct, a study of ideas or actions can be an invasion of privacy and subsequent publication can add stress to relationships with colleagues, students, and the general public. The normal way of life is not one full of openness and exposure. A case-study inquiry even into notions of science may raise questions which lay bare commitments that provoke approbation.

Essentially the same questions may be raised elsewhere with little need for protection. If a casual acquaintance raises such questions, the respondent feels free to answer or avoid the question. If an official raises such questions in an employment interview or promotion review, if a teacher raises such questions in the course of student examinations, if a citizen raises such questions of a candidate for election to the school board, the respondent is under some obligation to answer but with the understanding that that is part of his responsibility there and with the potentiality of personal benefit. Confidentiality is less an issue if the respondent has placed himself/herself in the review situation and has something to gain from the review.

In the CSSE research situation we are agents of a national bureau using public moneys, observing and asking questions without obviously having something to offer in return. The respondent makes an important contribution to the research. He/she increases the flow of information that may serve to correct a problem. These contributions may give the respondent satisfaction, but he/she will probably receive no other recompense for the risks taken.

The same argument pertains to institutions although obviously they do not have the same rights and vulnerabilities as persons. A school itself has some real chance of being embarrassed, beyond the embarrassment suffered by individual educators or students. The findings of a case study might result in embarrassment to the community that itself constitutes that school. (Whether or not the embarrassment is or is not justified is not relevant at this point. It is not the responsibility of the CSSE study to root out individual or institutional infirmities but to perceive national commitments and problems.) By granting our request for access and assistance, we believe the individual school and the individual persons we observe and question are entitled to anonymity--should they care to exercise it.

One of the requirements for this study demanded by the National Science Foundation, the sponsor, was the right to retain any and all data, findings, and documents. No release is to be made without the explicit authorization of the Projects Officer, an NSF official. For whatever other merit it has, this requirement could serve to extend the protection for a school or person studied. Yet additional control of data release is needed--particularly control by those who might be hurt.

CSSE STATEMENT NO. 4
(continued)

In their case study research Barry McDonald and Rob Walker have established a policy that a person owns the data on himself. They have routinized the return of transcripts and narrative descriptions to the people concerned for review, correction, and possible confiscation. The respondents are asked to judge the material on the basis of its accuracy, fairness, and relevance. MacDonald and Walker report, however, that, contrary to popular expectation, people (including bureaucrats) seldom exercise the options other than occasionally a request for correction of fact and fail even to claim anonymity in those rare instances when they have behaved in a way that some people would consider reprehensible. A respondent review procedure has merit apparently but is cumbersome, open to capricious threat to the research investment, and does not always serve its purpose.

Lou Smith has advocated reliance more on confidentiality and anonymity. He tells almost no one whom and where he is observing. He uses pseudonyms, falsified noncritical descriptions, and makes composite narratives from isolated events. He even considers publishing under a pseudonym. This policy has the considerable disadvantage of denying the reader the opportunity of applying what he already knows about the case. But it does grant a greater protection to the people at the site.

For the CSSE project we intend to follow the lead of these colleagues, granting anonymity and review rights. Prior to NSF consideration of release, the persons who have been observed and those who have given us their observations will have opportunity to review the case study materials. They will have full right to withhold any information that identifies them. Though asked to base their decisions on accuracy, fairness, and relevance, they will not be obligated to show that the information is objectionable on those grounds. They will not have the right to withhold information gained from contact with them if the opportunity of identifying them with the data is negligible.

The location of the sites and the names of the people will be kept confidential. Participating school officials will not be encouraged to publicize involvement in the study. Of course, they may choose to do so and to publicize the case study of their school cluster, once duly released. It is likely that some schools will eventually be reported with full identification of names and places and that others will be reported with person-and-place anonymity. The CSSE staff will try to maintain a strict anonymity at the outset and relinquish it only when mutually desirable to do so.

Complete anonymity is impossible. Project staff in the field will know where they are and with whom they are working. Someone must know how to get in touch with them. NSF must have some indication of where the work is being done for its accountability procedures--hopefully no more than one person (and a sealed envelope) in Washington need know. There will be a small number of people (perhaps for each site) who will know where we are--we will urge them to be discrete.

These may seem like drastic measures to take for such a benign and impersonal inquiry. Perhaps so. It seems to us that they are costly and even bothersome procedures but justified for the protection they may give and for the increase in openness and honesty we may expect while probing basic understandings and feelings. If we find that our procedures are extravagant and unwarranted, we can relax them. If we start out without them and find we should have had them, we may be unable to fulfill our contract to identify the meanings of science and the threats to science education at the precollege level in the USA today.

Clearance Procedures

Given our policy on confidentiality and anonymity, clearance procedures were needed for the case studies and other data reports. Our guidelines stated:

> Case studies and other CSSE reports are to maintain anonymity for cities and schools unless no objection to identification is found. Anonymity for persons either as actors or informants has been guaranteed and should not be compromised.
>
> The author of the material has the primary responsibility to clear it. He/she can circulate rough or smooth materials to each person who is involved. Question should be raised as to whether or not the place or persons can be identified, as well as to pertinent inaccuracies. (Irrelevant inaccuracies may be introduced to assist in maintaining confidentiality.)
>
> Persons should see only those materials that relate to themselves as actors or that include information they provide--plus sufficient context to get a full meaning of what is being said. The writer should direct the reviewer's attention to those items deemed crucial to personal identification and those bearing most directly on important issues for the particular case study or total CSSE project.
>
> A particular problem occurs when an episode requires clearance from two or more persons but part of the critical information is not known to all of them. Some of the information may have to be censored from the review--and possibly from all reviews at that site. This would be done only to protect an actor or informant from exposure.
>
> If there is information on record that will indemnify a person who explicitly or implicitly granted us access to this information, then all the data information should be destroyed when no longer useful for analysis, and not later than the date of the submission of the project final report to NSF.
>
> When all personal episodes have been cleared for accuracy and anonymity the site coordinator should clear it with the school authorities at both building level and district level. Again, checks should be made for security of identity of persons and accuracy of fact and implication.

An illustration of our guidelines translated into action at the final stage of transcript review is shown in a communication to VORTEX reviewers by the field observer there.

To: Readers of the VORTEX Case Study

From: Gordon Hoke

Re: The contents

1) I tried very hard to hold the material to about 4,000 words or 20 (double spaced) typewritten pages. Acknowledgement of this standard meant that a great deal of information had to be eliminated.

2) Much of the data obtained in VORTEX, in my judgment, carries great significance for the organization and management of schools and will be useful as resource material for other parts of our final report.

3) The "mini-portrayals" and lengthy quotes are typed in double-spaced fashion to expedite your reading. They will appear in the usual format in the final version.

4) VORTEX readers: please indicate questions, corrections, etc., on individual pages and return them with the enclosed envelope.

5) A complete edition of the final report will be forwarded early in 1978.

The drafts of the case studies seemed to include very few anxiety-producing or indicting revelations. A number of people who reviewed them for revision found inaccuracies and were disappointed sometimes in the tone or choice of incidents to portray--but there were almost no expressions of need for improving or even preserving anonymity.

In retrospect we believed that anonymity remained an important matter. We did not learn much about how to handle it, partly because our case study writers seldom presented information that put any one person in jeopardy or even cast them in a "bad light." Our clearance reviews were too casual, too occasional. Our records do not sufficiently show that all persons potentially in jeopardy did have an opportunity to review and did give us assurance that publication was not contrary to their interests. We were comfortable that persons were in fact reasonably well protected. The field observers and site administrators effectively established a climate of "trust." Institutions were left anonymous not because they needed it but because it was too much work to "declassify." Still, better techniques are needed.

SITE VISITS

The second phase of our project was the site team visits. Since our observers would not usually see more than one site, making it difficult to draw together a general picture, multiple-observers were used to confirm the existence of phenomena or attitudes, to help develop survey scenarios, to assist the field observer in difficult tasks, to add the views of certain specialists and to gather additional data on issues of special interest.

The design of the visit varied from site to site. Usually it consisted of a team of four to six members on site for three days toward the end of the field observation period. (This is graphically portrayed in Chart 1.) The visitors were to overview the site and provide confirming or disconfirming information to the field observer for the preparation of the case study for that site, and to further the preparations for writing the assimilation chapters. Interviews were regularly tape recorded for later analysis.

Site Coordinators. Each site team was coordinated by a project staff member from the University of Illinois:

Terry Denny, specialist in evaluation of teaching materials
Jack Easley, science and mathematics educator
Gordon Hoke, specialist in innovation and school-community relations
Robert Stake, educational evaluator
Charles Weller, science-teacher educator

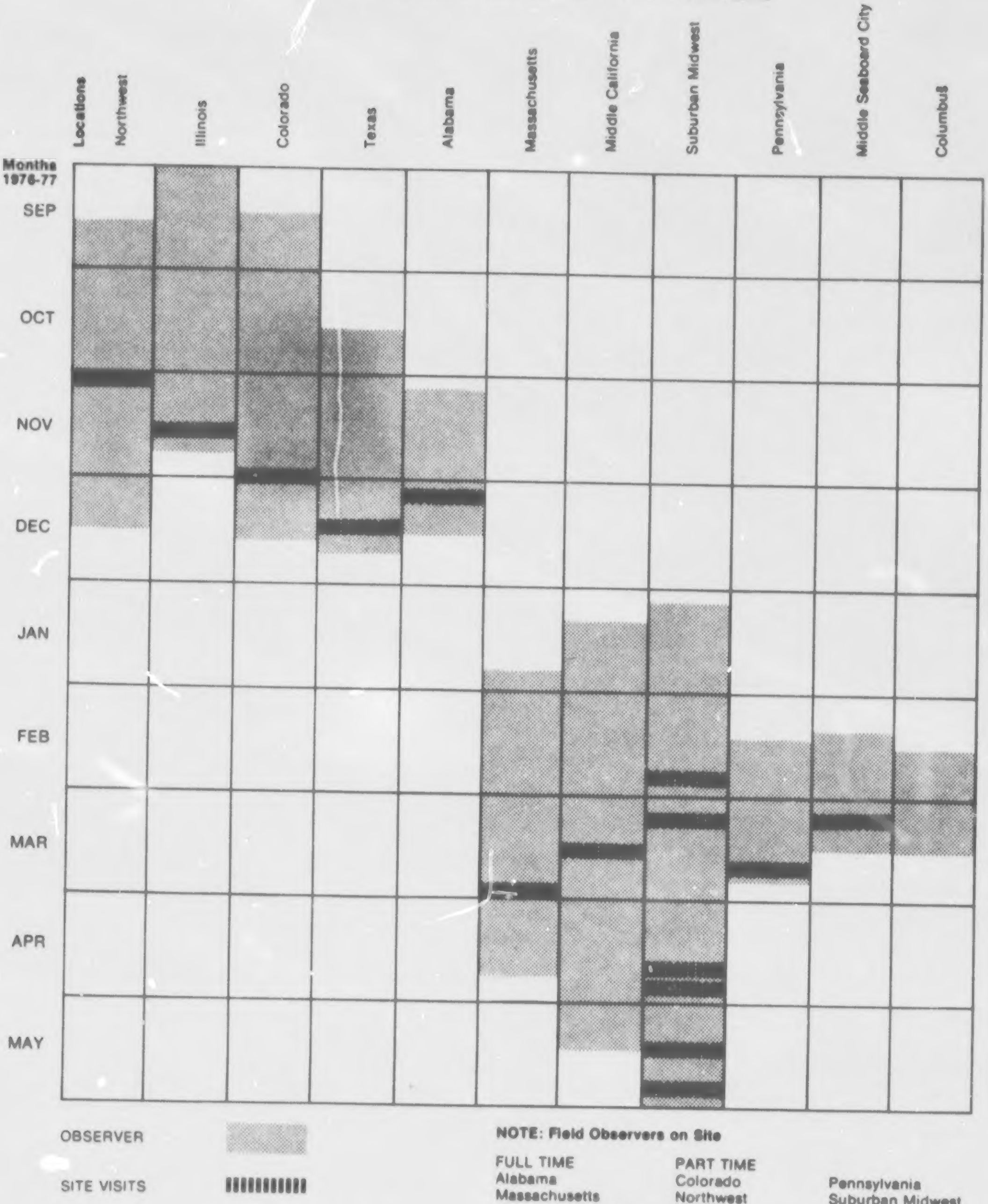
Typically, the site coordinator visited the site early in the work there and then returned to make arrangements the week preceding the site visit. His duties included selecting the members of the site team and identifying the key respondents from the site. He was to link the questions identified for probing to particular site team visitor's interests and expertise, and to find particular respondents thought to have ideas, information and feelings about those questions.

Composition of the Site Teams. A team was usually composed of a member of the local community, a math and a science educator, scientists, educational policy people, or experts in evaluation strategies. These members of the team were selected for their particular expertise in scientific and educational matters. The theoretical perspectives represented by the site team members included disciplinary allegiances to the natural sciences, mathematics, psychology, sociology, anthropology, and linguistics.

Previous knowledge of the school system under study was an important factor for selecting at least one member of each team. In several cases they were local community members; in others, people who had previously been involved in consulting at the site. Local people on the team were helpful. They often could clarify issues that were being discussed and helped us gain access to teachers and others.

In the round of site visits during the spring the same general pattern of site visitor backgrounds was retained but the site team was more likely to include CSSE personnel who would have responsibility for writing sections of the final report. By this time issues were being clarified and extensively discussed among CSSE personnel. As more of these people were included as site visitors, the more intense and immersed in the issues the project headquarters became.

CHART 1: Schedule of Field Observers and Site Visit Teams



NOTE: Field Observers on Site

FULL TIME	PART TIME	
Alabama	Colorado	Pennsylvania
Massachusetts	Northwest	Suburban Midwest
Middle seaboard city	Illinois	Columbus
Texas	Middle California	

Site Visitor Responsibilities. Each site team member wrote a report at the site or soon after leaving. All of the site reports were descriptive. Some contained vignettes, some were evaluative, and a few concluded with recommendations One was a critique of teachers and math classes. The methodology of participant observation and interview was common to many members of the site teams but uncommon to others. There were large differences in what the site visitors did, although all reports were written from classroom observations, formal and informal interviews, and written data sources. Examples are included at the end of the VORTEX, URBANVILLE and GREATER BOSTON studies

The arrangement of interviews, discussion sessions and observations were opportunities for site team members to pursue their principal responsibilities. The tone and spirit of these responsibilities perhaps was captured in CSSE statement #25 (on the next page).

Data Collection. While we were primarily committed to studying a particular topic--science education--we were also committed to studying the specific context--a school cluster --the circumstances under which science education occurred. Our belief in the influence of context on teaching and learning led to the investigation of many topics deemed important to a school district. We were of course aimed at description--as might be expected from this statement by McCall and Simmons.*

> *In general, choosing the organization in terms of the topic tends to be associated with theory testing, whereas, choosing the topic in terms of the organization favors description and discovery of theory.*

Interview assignments were usually given to each site team member by the site coordinator in consultation with the field observer. The intent was to enhance the utilization of the personnel on the team as well as gather data on questions identified as important at that site. By the time of the spring site visits those issues which had emerged from previous sites were included in the probe. An example of this is seen in an urban site where the site coordinator (Stake, Middle Seaboard City) defined the observational-interviewing needs in this way:

Dunkum (Science Supervisor)
    Science and math curricula: Are texts and materials suitable?
    Support systems: Where does a teacher go to get help?
    Special education: Is mainstreaming burdening the classroom teacher?
Meyers (Elementary Classroom Teacher)
    Elementary education: How substantial is the content?
    Student motivation: Do teachers have rewards that students care about?
    Counseling: What are counselors telling students about science and math?
Rodgers (Professor in Early Childhood and Elementary Education)
    Social studies: Is there any social science being taught?
    Administration: What obstacles are there to improving teaching quality?
    Political climate: How strong is the influence of the local news media and city council?
Stake (Co-director of the Project)
    Curriculum: How strong is the back-to-basics movement?
    Articulation: Is there conflict between options and uniformity ethics?
    Test scores: What is happening to student achievement?

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*George J. McCall and Jerry F. Simmons, eds., Issues in Participant Observation (Reading, Mass.: Addison-Wesley, 1969), p 66.

CSSE STATEMENT #25
SITE VISITOR RESPONSIBILITY

Stake
October 29

What this country needs perhaps--even more than a 5¢ cigar--is a succinct statement of how science education is seen here at this site. As a site team member you should assume a primary responsibility to author such a statement.

Your statement will differ of course from those of others on this team, and from those on other teams. It should reflect your own experience and value-commitments. But it should not be your view of science education. It should summarize your view of their view of science education. Science education includes mathematics and social science education.

The case study is a study of the people involved in science education at this site. It includes students, teachers, parents, administrators and others. Of course from this brief visit you won't know all views or even a good representation. But you will quickly know some views that are worth the consideration of distant readers.

Your statements can be brief. Perhaps no longer than 300 words. It is needed rather soon. Perhaps you will write it while you are still on the site.

The purpose of the site visit is three fold: to report new issues (and interpretations of issues) regarding contemporary science education; to confirm or disconfirm the observations of the field observer; and to refine the statement of issues in scenario format for a subsequent national mail survey. The site coordinator will worry about most of this. Your statement will help toward all three purposes.

A second responsibility of each site visitor should be to review the draft of the case study when the field observer prepares it. Reactions to confirm or question major findings are needed at that time.

The total CSSE project has 3 principal questions to answer. 1. What is the status of precollege science teaching and learning today? 2. What are the conceptualizations of science held by teachers and students? 3. What happenings in school and community are affecting the science curriculum? Your statement and review may direct attention to one or more of these questions.

We don't really know if the country needs our answers to these questions. But we hope to have a good supply of well substantiated answers.

Generally, the visits were organized to include situations for data collection with the site team members interacting with common data sources--teachers, students, administrators, curriculum supervisors, and parents. One schedule was summarized as follows:

Night before: Discuss site and issues with observer and coordinator, set up division of responsibility. Debrief field observer.

And in the next three days: Meet school officials, discuss current programs and problems, visit several schools, hold interviews in groups and individually. Present issue-scenarios to teachers, administrators, and citizens in groups of three to eight. Hold summary of issues sessions with project personnel.

In arranging the site team three-day visit coordinators tried to maximize the amount of information already available at the site. They provided written information to site team visitors in the form of newspaper clippings, school district newsletters, and demographic descriptions of the site. Discussions with the field observer provided other basic data on the community to the site visit team. These discussions were held previous to the first entry into the schools.

Coordinators also tried to provide time for reconnoitering discussions by site team members and field observer throughout the visit. These situations provided opportunities for clarification, amplification, and substantiation of observations and interviews.

In addition, coordinators tried to provide information for refining and modifying the scenarios for the national survey. (See section C:4 and Chapter 18.)

These scenarios were to reflect more than the immediate problems in a local district, yet retain a sense of immediacy and relevance to the local teaching and learning situation. This combination was difficult to achieve in the site visit interview situation. While it was generally found that the scenarios served as "ice-breakers" for discussion and seemed to orient people to the purpose of the interview, few respondents spoke directly about what was in the scenario unless asked. Our lines of questioning pursued their responses and were spontaneous more than they were probing of the scenarios. Site visitors used and helped modify the scenarios less frequently as the project progressed.

It would be inappropriate to describe a visitor's presence on site as "complete observer." There was never complete removal from social interaction. Neither were they "complete participants" in the sense of pretending to be an aide, teacher or consultant. Our introduction to respondents always identified us as researchers from outside the school district. And our tape recorders and notebooks were ample evidence of our intent to gather information.

The predominant mode of operation was that of "observer-as-participant" since we were involved in one-visit interviews and observations. This role usually entails brief contact with many respondents; however, with the assignment of a local person to our team and the site coordinators arrangement of topical areas of concern to particular site visitors, the time spent with respondents on particular issues was maximized.

Under these circumstances both individual and group interviews were held. Interviews were regularly tape recorded. They included respondents from the community as well as students, teachers, and administrators. In the case of community members and in keeping with our commitment to anonymity, it was left to the discretion of the school district to invite community members. We did get useful information about citizen feelings concerning local and national programs of pre-college science, math, and social studies.

Meetings open to large numbers of volunteer informants from the community were abandoned early. There appeared little interest on the part of the community members. However, informal and formal interviews with individual parents as well as with small groups of community members or school personnel were successful when invitations were personally extended, particularly if by a member of the school system. We found individual interviews to be conducive to frankness and opportunity for clarifying issues.

Situations with larger groups of people permitted respondents to react to each other and provided the site team with insights not otherwise available. For instance, one site visitor had observed what he considered an authoritarian style of teaching in the classrooms. He described it as the "shout and bang method of instruction" and thought it might be exclusive to the classroom. However, during an informal gathering of several local school district personnel he observed its more general character:

> In all classes which I observed (they all happened to be taught by men) the mode of teaching was by shouting out the information and banging on the desk with the flat of the hand for emphasis. Even a teacher who was mild mannered and softspoken in a private conversation with me shifted into this style when he got "into" his lesson and the adrenalin started to flow. I thought this behavior might be unique to classroom situations because the acoustics were so bad, but after sitting through friendly discussions in the men's lounge and a social hour with several principals, in which the walls of the room fairly shook from the "bellowing" at each other, I became convinced that the classroom technique was only a specialized case of a much more general mode of communication. The amazing aspect of these situations was that none of the participants were at all offended by being shouted at--in fact, one participant even changed his mind in the midst of one of those seemingly "heated discussions."*

Respondent Sampling. The CSSE approach to sampling of teachers, students, administrators, and parents consisted of three general approaches commonly used in participant observation.

The first--"some sort of quota sample" was used most often. It provided us with information from the categories of school district "members" just cited. We interviewed and observed at least a few people from each of these categories. They were often selected and introduced to us by administrators in the local school. Often we talked with respondents that we met informally in lunchrooms and teachers' lounges. Or occasionally our local team members knew of people we would be interested in talking with and introduced us to them.

The second type of sample--"the snowball sample"--was used when a site team member found an issue that needed clarification or elaborations. The original respondent then directed the site team member to others in the school system who might have the desired information, and they to still others.

The third type--"search for exceptions"--was employed more commonly as the identification of issues progressed. This approach was utilized when a relationship between categories of people and/or events was taking on the appearance of a hypothesis and time and opportunity permitted its use.**

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*Charles Weller, Site Visit Report.

**George J. McCall and Jerry F. Simmons, eds., Issues in Participant Observation (Reading, Mass.: Addison-Wesley, 1969).

Participant observation with the emphasis on observation and interview, rather than participation and interviewing, a group site team visit, and assignment of team members to an area of concern to the field observer or site coordinator were the characteristics of nine of the school district visits. In ALTE we utilized a different site visit design. In Columbus, Ohio, we held no site visit.

Site visit reports from URBANVILLE and VORTEX are appended to the case studies. They illustrate how the site visits provided descriptive data that the field observer felt extended information he or she did not have an opportunity to pursue and confirmed or clarified the general overview of the case study. With another case study (GREATER BOSTON) a site visitor's report portrays a contrasting view to that of the field observer Rob Walker. This brief report illustrates the inherent strengths and flaws of case study methodology. It is less a matter of which viewer is right or wrong and more an issue of what is important to and valued by the individual observer.

Site Visit Design for ALTE. The suburban midwest site was handled slightly differently both in terms of the site team concept and the amount of participation of team members. The site coordinator, Jack Easley, described it in the following manner:

> In keeping with the CSSE project desire to adapt the site visits to the varying expertise of the site team observers two changes from the fall semester site visit design were made in one school district, ALTE. One of the two efforts was to select site visitors with expertise in programs that were of current interest. The second effort was to schedule visitors at several different times rather than as a team effort. (See Chart 1, p C:38) These changes were made, primarily, to permit observers to get into the workings of the curriculum development process in the schools, which appears to be unusually active at this particular site. The details of the changes included the following points:
>
> 1. We have sometimes chosen site visitors for a particular site because of their expert knowledge of a particular problem the school district is facing, and we have used local citizens and scientists on site visit teams in part because of their interest in and knowledge of the site. It is therefore only another step in the same direction to have site visitors with a particular expertise desired by groups working in the schools on curriculum development or program reorganization. This permitted the site visitor to play the role of consultant to the school district as well as to the CSSE personnel.
>
> 2. For the school district the visitors were chosen so as to cover as many of the aspects of the science, math, and social studies programs as possible within the allotted budget. And they visited at times that optimized their ability to contribute to the program development process.
>
> 3. The spreading out of the site visit in time permitted a more natural integration of the visitors' interactions into ongoing curriculum and organizational development of the schools. It also permitted the field observer to observe this interaction and thereby discover in a more concentrated time span the kinds of use the school normally makes of consultants in different curricular areas.
>
> 4. This use of site visitors provided an opportunity for a more concentrated effort on specific topics--teaching and learning. Observation and interviews were more articulated and focused on these topics in order to provide a more in-depth analysis of particular issues for curriculum development.

In sum, an in-depth opportunity was provided to integrate the site visit(s) into ongoing work in the curriculum process at this site and extensive quotes from the site visit reports were included in assimilation Chapter 16, The Teacher In The Classroom.

SURVEY

The survey, described in detail in Chapter 18, was planned originally to provide additional interpretations and information on the extent of generalizability of case study data. Issues developed in Phase I and II were to be the primary conceptual structure of the survey. These issues were to be portrayed through an issue-scenario.

The scenarios first developed from verbatim quotations recorded at our sites were found to be too fragmented and too frequently rejected by our try-out questionnaire respondents and onsight reviewers. As we departed more and more from the descriptive detail of the site situation we saw it decreasingly possible to capture the complexity of local issues. We moved gradually toward describing more general situations and toward issues as they were seen generally. The emphasis was then shifted to a more contrived, purposive scenario based on what we perceived to be major issues in the field and the literature. With this approach our purpose changed also from one of confirming the case study findings to gathering fresh information on key issues.

Multiple Case Study Project

> It may be useful to distinguish between a case study project which is the persistent study of a single case and the multiple case study project, which is a collection of individual case studies--where one tries to make the several case studies alike in some ways to provide a synthesis of findings to the reader trying to understand the whole collection.
>
> Special research procedures are needed, of course, for the multiple project. Unfortunately, those procedures are not well developed--so far it is pretty much a matter of following one's intuition.*

Natural science seems to progress rapidly in comparison with social science. One reason is that natural science chooses problems to solve for which the methodology has been perfected. They choose problems that can be assumed to have solutions. However, social scientists usually do not select problems according to the sophistication of the techniques they have available. Important problems to be explained are constantly pursued regardless of whether the appropriate methodology has been well developed.**

If as Francis Bacon suggested, "truth emerges more readily from error than confusion" and the sense of situations can only be acquired after some action has been taken*** then we should act and reconsider in order to move along toward making sense of the situation. That is what we tried to do.

Obviously multiple case studies demand a form of linkage--a manner in which to discuss their differences and similarities. The methodology for aggregating wholistic data from multiple observers at multiple sites and comprehending the overview is one that is little examined in the methodological literature. However, large scale projects that we are aware of have allowed for a number of independent pieces of fieldwork and reporting that provided some fascinating cross-site comparisons. The descriptive account of the case study is the basis for these comparisons.

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*Robert E. Stake, "Seeking Sweet Water: Case Study Methods in Educational Research" (Urbana, Ill.: Center for Instructional Research and Curriculum Evaluation, AERA Training Tape Cassette, forthcoming).

**Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago: The University of Chicago Press, 1970).

***Karl E. Weick, *The Social Psychology of Organizing* (Reading, Mass.: Addison-Wesley, 1969).

One method was being used by The Center for New Schools in Chicago. They were studying ways school people go about trying to solve their problems. They had ethnographers in nine different school districts around the county. It also was a multiple-case project. In this project, The Documentation and Technical Assistance Project, Tom Wilson and his colleagues sought an understanding of how to enhance the capacity of schools to solve problems through knowledge utilization of research and the experience of practitioners. The limitations of disseminating information for problem-solving exclusively through the case study approach have been noted.* These limitations led project personnel to explore different methods of aggregating case studies. Their primary method included use of a computerized coding system, converting ethnographic data to bits of natural language reports coded and stored in a computer.

Another method proposed for dealing with the problem of aggregating data from case studies is to analyze the content of case studies with a closed-ended questionnaire containing questions regarding pertinent issues. The resulting analysis becomes "case survey method." It may allow an analyst to aggregate the case study experiences across sites.** Cases that do not have information for the questionnaire are dropped. This may be more suitable for developing theory than for understanding a particular group of situations. It neglects key information that is available in a case study report--the context of a situation. Context is utilized more for decision making.

A lovely example of the use of a case study for decision-oriented findings is David Hamilton's "The Case of the Missing Chairs." The question was whether or not, in a new primary school, with open classrooms, to provide one chair for every child, or fewer chairs. A trivial question? Not in terms of cost, and not in terms of instructional method. Here are three paragraphs from Hamilton's report.

> *In 1973 the situation changed. The plans for the new lower primary building had reached the state where a seating level had to be decided. Consensus among the staff was difficult to achieve since individual members reacted differently to the idea that seating levels might be reduced below one chair per child. . . .*
>
> *To resolve this issue the headmaster of the school was asked to act as an arbitrator. By his decision the seating level was duly fixed at sixty percent. In principle this action closed the debate. In practice, however, the teachers were left with a possible alternative: if the designated seating level proved inadequate, it could still be topped up with infant-sized furniture left over from*

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*Steve Wilson, "Influences on the Usefulness of Case Studies" (Paper presented at the Annual Meeting of the American Educational Research Association, New York, 5 April 1977).

**Robert K. Yin and Karen Heald, "Using the Case Survey Method to Analyze Policy Studies," Administrative Science Quarterly 20 (September, 1975): 371-381.

> *the old buildings. The flexibility of this arrangement became apparent when some of the ordered furniture failed to arrive in time for the opening of the new building. The old tables and chairs were immediately pressed into service and, in a complete reversal of the original intention, were "topped up" by the new furniture as it arrived. Eventually, a surplus of chairs was created--which meant that each teacher could operate their own seating policy. Some chose the figure of sixty percent while others retained at least one chair for each child.*
>
> *This arrangement did not last for very long. Within a term all the teachers had built up their seating levels to at least one hundred percent. The topping up, however, did not herald a return to class teaching. Quite the reverse: as shown below it marked a recognition that an adequate supply of chairs was necessary to the individualized and balanced curriculum that the case study teachers were trying to implement. Thus, despite a certain sense of public failure among the teachers who tried to work with a reduced provision, the intervening experience had taught them a great deal about the relationship between teaching methods and seating requirements. . . .**

It is not surprising that case study research can be used to aid in the understanding and resolution of a local problem. But the Hamilton study is illuminative for teachers and administrators of primary schools in many countries.

Although Hamilton's report is single issue specific, and our case studies are not, we made use of issue-specific thinking in our assimilation chapters.

Project Management. As indicated earlier, we set up a Temporary System to organize and operate the project. It was based on high personal contact and conventional filing systems.

The temporary system operated out of Room 260 Education, at the University of Illinois in Urbana. The five site coordinators (Stake, Denny, Easley, Hoke, and Weller) officed there, with short and long-term visitors, graduate students, and secretaries. On a typical occasion one might have found a couple of coordinators plus Kip Anastasiou working on the "elitism" topic, Helen Simons helping draft a statement on field methods, Peg Steffensen coding tapes, Jo Day coding incoming research reports, and Gordon Hoke telephoning an assistant superintendent.

The coordinators came and went, briefing others, filling file folders. Seminars ran almost continuously, a couple for course credit (led by Charles Weller and Bob Stake), others informal. There were long running conversations with graduate students and interested colleagues about such tasks as issue formulation, analysis, scenario writing. There were debates on the significance of this or that finding.

Scrapbooks, window panes, file drawers, cabinet filled up. Telephones rang. Decisions were about adding or dropping a site, subcontracting, clearing the site visitor list with NSF. One secretary was kept busy most of the year just on travel arrangements and vouchers. These were normal administrative concerns, yet most interacted with content and method of this multiple, simultaneous case studies project. Issues emerging from the sites colored the administrative decisions, which in turn reflected back on the field work. Were the coordinators too intrusive? too demanding? This temporary system functioned, fought out and strained at the issues, "doing its damndest with its mind(s), no holds barred," as Percy Bridgman* said it ought to function.

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*David Hamilton, "The Case of the Missing Chairs," Education 3-13 4 (October 1976): 113-116.

The most important finding is that there is no inquiry going on out there.

Was there ever any real inquiry?

Maybe that wasn't important.

Pupil motivation is the real issue--

But that's not always a thing teachers worry about.

Yes, but they should.

Well, that's not our problem.

Out of the confusion of too many issues, too many personalities, there gradually emerged a tentative consensus of findings. It took a lot of such argumentation within the temporary system to set aside (even temporarily) NSF rationales for course content improvement and to examine the rationales of classroom teachers and others.

DATA STORAGE AND RETRIEVAL

Data were collected by the field observers, site visitors, and the survey questionnaire. The formal mechanism for data transmittal to the project were respectively the case study, the site visitors' reports and tapes, and the responses to the questionnaire. The collection of these data was discussed in the sections labeled as Case Study, Site Visits, and Survey. These data were stored and retrieved in natural language (except for Survey) to form the basis for most of the issues discussed in the assimilation chapters. These issues, especially from the case studies and site visitors' reports, are local issues. Local in that they are embedded in a local context. However, these local issues can be and are discussed as universal issues sometimes finding confirmation through our national survey and at other times in current news articles or the professional literature.

In this CSSE project we addressed local issues as foreground and more universal issues as background. Both came into focus in our assimilation chapters. It is often the case that an issue at one site is prominant at many sites--like the issue of "back to the basics."

Our coding and aggregation system (see p C:49) emphasized natural language and permitted the retention of the context in which the issue was addressed. It permitted an analysis of the conditions under which such issues as "back to the basics" are of vital concern--as well as analysis of the multiple understandings or definitions of "back to the basics," etc., offered by our respondents.

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*Percy W. Bridgman, "The Prospect for Intelligence," Yale Review 34 (1945): 444-461.

CSSE STATEMENT No. 30
CATEGORIES OF TOPICS

Stake
Dec. 9

e
Epistemology
Conceptualizations of science

ea = science as the seeker of knowledge
eb = science as a vocational tool
ec = emphasis on college-preparation
ed = concern about humanism
ee = emphasis on biological science
ef = scientific analysis and inquiry
eg = the teaching of "values"
eh = science as value-free inquiry
ei = hierarchial aspects of knowledge
ej = the utility of science
ek = elitism of science
el = keeping scholarship standards high
em = basing knowledge on experience; hands-on

p
Pedagogy
School-University Split

pa = teacher education curricula
pb = training stressing theory vs practice
pc = relating to kids; child-centered teaching
pd = no language for kids' ideas
pe = teachers' values, styles
pf = teacher as diagnostician
pg = learning the logic of wrong answers
ph = class heterogeneity
pi = classroom discipline
pj = student motivation
pk = emphasis on competition
pl = resources for aiding teachers; inservice
pm = summer institutes and such
pn = teaching the textbook; teaching the test
po = quality of teaching materials, equipment
pp = tracking
pq = competence of teachers

c
Curriculum
Back to the Basics

ca = the 3 R's
cb = course mastery, proficiency diploma
cc = molecularization, learning modules
cd = specificity of goals
ce = uniformity across classes, schools
cf = articulation
cg = metrication, decimal fractions
ch = hand calculators
ci = outdoor education
cj = taboo subject matter
ck = Mr. Science
cl = the counsel counselors give
cm = the math curriculum
cn = nonschool learning opportunities
co = sex education
cp = social studies curriculum
cq = facts vs concepts; skills vs understandings
cr = remedial courses
cs = the science curriculum

s
Socio-economics
School and community

sa = budget cuts, economic support
sb = reduction in teaching force
sc = enrollment drop, class size
sd = employment of youth
se = social pattern of youth
sf = demographic changes
sg = local vs state-federal control
sh = parent, community pressure
si = school organization and management
sj = shrinking role of the school
sk = desegration/integration/busing
sl = bilingualism
sm = mainstreaming; equal opportunity
sn = teacher associations, unions
so = difficulty; expectations of difficulty
sp = accountability

The issues were found in explicit discussions and in descriptions. As tapes and documents were received at "headquarters" the sections were coded, often multiply coded, as potential information for sections of the assimilation chapters. They were duplicated and hand filed in notebooks under specific assimilation chapters and subchapter headings. Newspaper articles reflecting CSSE issues in a broader context were coded in scrapbooks. Particularly relevant professional literature was coded and filed in file drawers and on bookshelves. The notebooks, scrapbooks and files were kept in one place in the CIRCE offices, accessible to all who worked on the project.

The codes used at one time are shown in CSSE Statement No. 30. These codes functioned as flags for the authors of assimilation chapters and subchapters. It allowed them to sift through the information collected on an issue and to organize it in a conceptual structure. It also permitted them to go back to the original source of the data to reconfirm or change interpretations. The coding system was useful in getting things organized, but as final deadlines neared, it seemed less necessary than we thought it was going to be.

Our data processing operations were:

1. interview tape analysis (Peg Steffensen)
2. site visit synopsis and newsletter (Gordon Hoke)
3. survey processing (Beth Dawson)
4. materials classification (Jo Day)
5. indexing (Kathy Jaycox)
6. issue analysis (Bob Stake)
7. conceptual analysis (Jack Easley)

Each operation was assigned to the particular person shown but it was a joint effort involving many people. It demanded a high level of intercommunication among CSSE personnel. Our approach to the task was one of maximizing personal contact of observers, site team coordinators, and headquarters personnel. Fortunately these people enjoyed working and enjoyed working together.

WRITING, ANALYSIS, WRITING, AND WRITING

The time to prepare the case studies after observation, both for the field observers to write and for the issue analysts to analyze, was not amply allowed for. We had planned to read all the case studies in June with each person in charge of pursuing an issue marking out what belonged to him/her and what ought to be considered by someone else. Our inability to work with all the studies at the same time clearly influenced the way issues were developed, though it did not become clear what implications this might have. For example, we analyzed the pressure for uniformity and belief in hierarchial subject matter while studying the rural case studies (which were available) but not the inner city case studies (which were not available then).

More often than we anticipated, a writer would need to go back and re-read each case study again and again. It was inefficient but the best mode of operation we found. Often a circulation of a chapter draft would draw a flood of cross references to details in other chapters. Weekend writing conferences helped this process on two occasions. The digesting, coding and analysis of the case studies was not accomplished as early as intended. Ultimately this reduced the number of sessions we had intended engaging in to go over and over the assimilation statements, refining and correcting them.

We found Rob Walker's rule, "a day at home writing for every day in the field" to be an underestimate of what was needed. Francis Stevens (a site visitor) reported needing several weeks of writing after a day and a half and 20 hours of tape from the field. We know that we ought to be able to provide case study data to sponsors in less than eighteen months but we kept finding steps that needed more time than we allowed ourselves.

ASSIMILATING ISSUES ACROSS SITES

The task of the assimilation chapters was set as one of advancing understanding of issues across sites. We decided early to concentrate on the five or six most dominating and interesting themes that ran through the case studies. We expected this synthesizing of data would address most of the explicit questions raised in the RFP. While major themes that emerged in the story subsumed many issues raised in the CSSE proposal, we found ourselves short of the grand schemers and writers that this approach required. Our major themes were reduced to Student Heterogeneity, Quest for Uniformity, Back to the Basics and Socialization as a Preemptive Aim. These were written up by Bob Stake and Jack Easley.

Jack Easley and Bob Stake preferred different approaches to the task. Easley wanted to use the case studies as background or platform for studying the mechanisms of rejection often encountered by curriculum project and other teacher support efforts. He chose to concentrate more on site visit reports, to do more of a policy-analysis study, adding other data to CSSE data, rather than to digest further the already well-digested case studies.

Bob Stake wanted to continually draw the reader's attention to the case studies, saying we know many scenes are particularistic or ambiguous but the interpreted information about science teaching and learning is likely to be of more value to the reader than aggregated or interpreted information would be.

At times we found ourselves turning the assimilation chapters into an elaborate indexing task. We looked for what we thought would be more useful to NSF personnel and panels but found our acquaintance with them an inadequate guide. We asked ourselves "What would a curriculum supervisor, a teacher or a principal be interested in knowing?" and then searched for this information. We looked at principal findings in the survey on a particular issue and checked for counter messages in the case studies. Sometimes there were counter messages. We considered the survey from a case study point of view and could on occasion find counter messages there also.

In one memo a CSSE staff member said:

> This business of assimilation is tedious and discouraging. There is a strong temptation to read more into the reports than is there. When you look hard at what is there you see a different story in each of the several case studies. The vitality of each quickly disappears as you try to aggregate the findings on an issue. You wish that the observers had been much more closely in touch with each other, paying attention more to the same things--but you quickly doubt whether then they would have watched what really was happening out there. The demands of research for repetition of happening and the uniqueness of educational acts seem to be an immovable object encountering an irresistible force.

We hesitated, fearing the too simple presentation. Sometimes it is best to encourage more common perspectives. But standardization of purpose and procedure can be a harmful restraint upon research, both in doing and reading about it.

Difference in Co-Directors' Emphasis. A few lines back we noted a difference in purpose of the assimilation chapters. The difference manifested itself in orientation toward theoretical vs decision oriented findings that co-directors Easley and Stake had.

The mind-set of teacher or coordinator was the interest of Jack Easley, a member of the Committee on Culture and Cognition. He stated it this way in the proposal to NSF:*

> Teachers have images of what science is, what mathematics is, what the social sciences are. Those images tend to be formed by carrying out their responsibilities in the classroom. The images are personal. Teachers differ. Teachers differ from curriculum developers and others. . . .
>
> Solutions are not likely to be effective without a better partnership between the scientific community and the schools. . . .

Bob Stake, Director of the Center for Instructional Research and Curriculum Evaluation, was interested in curriculum evaluation and the context "frame factors" of education, especially as perceived by practitioners. He stressed that the perceptions of teaching should remain recognizable to the teachers even at advanced stages of interpretation. This is difficult to do when discussion passes into a theoretical stage. He wrote in the proposal to NSF:**

> The primary aim is to develop a sympathetic view of the situation in schools as seen by the persons who spend their time working there. If this situation is made more difficult or less difficult by outsiders (citizens, scholars, government agencies) we want to document that part of the situation too. The undeniable aim of these studies all over the country (and abroad too) is to make policymakers who deal with many schools sensitive to the possible effects their policies may have in schools which resemble in significant ways the particular schools studied here.
>
> The understanding of science in the country today depends on a drawing out of the issues in the classroom and across the community, and in interpreting them when possible in terms of the more abiding issues.

---

*Proposal to NSF, p. II-1a.

**Proposal to NSF, p. II-3e.

In a particular chapter of the final report Jack Easley developed implications for a theory of teaching and learning (Chapter 16). He noted with disappointment that these particular areas of interest were not as extensively investigated by field observers as he had expected. He wrote:

> One of the consequences of our design, in which we selected ethnographers, is that we managed to find a considerable number of very talented, creative writers who approached their task in various ways, and interpreted our presentation of project goals in various ways. Consequently, on some issues the case studies have to speak mainly for themselves. This does not mean that we cannot present general findings, but just that some of these general ideas are not directly traceable to any particular portion of the case studies, either collectively or individually. Our general findings presented here are mostly the creative synthesis of the coordinating staff who worked with ethnographers, collected data on site visits, and discussed the issues that were emerging from the complex interactions with very talented and diverse scholars. The case studies themselves bear some influence of these interactions, but again the influence is interpreted in creative diversity. This particular discussion, therefore, is simply a digestion and resynthesis (analogous with assimilation) of a variety of parallel activities in eleven sites and involving some thirty-odd scholars and experienced school observers. Each case study on the other hand, is an assimilation of a concentrated interaction with personnel working in a given cluster of schools and of a much more limited interaction with project staff and other ethnographers.*

Stake said:

> I organized the field observer orientation sessions and drew up the conceptual structure for the survey. Thus these efforts might have served only my aims and not Jack's, but I was pleased to see that he found much in both places relevant to his basic questions.

Most assimilation chapters use the case studies as the primary data source for a description of issues, relying on site visit reports for confirmation, instances of exception or additional information. One section of the chapter, The Teacher In The Classroom, differs methodologically. It primarily uses the site visit reports for a theoretical explanation of one particular issue, "Why teachers are reluctant and even hostile toward the best efforts of scholars to help them."** For this issue the case studies provided supportive statements but not as much confirmation as was desired. Surprisingly, perhaps, the preparation of the executive summary turned out to be a relatively easy task, with essentially no disagreement as to what should be said.

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*Jack Easley, Chapter 15:d-1.

**Jack Easley, Chapter 16:1.

Interpretation. In any study, interpretation of observations is a constant activity of the responsible researcher. To many people, the case study and the assimilation of case studies seem overly subjective, overly interpretive, especially during the data gathering phase. And many find the final product underinterpreted, too susceptible to numerous interpretations.

We tried to restrain interpretation during data gathering and not to impose our interpretations too much during the assimilation. Only under pressure from the NSF did we prepare an executive summary (Chapter 19). We found this to be an opportunity to make one synthesis and encouraged readers to make others. We limited our recommendations to what we saw as directly following from the observations.

One advantage of the case study method is that it fits a reader's experience and thinking patterns. To be highly interpretive interferes with readers making their own interpretations.

> Good research needs skeptical thinking and systematic replication. What is missing in case study work is automatic, built-in cautiousness, much as you have in statistical testing of the null hypothesis.
>
> And so it's too likely that a reader of case study research will overinterpret the findings, presuming them to be relevant where they are not. In other words it is likely they will make Type II errors.
>
> But they will make Type I errors, rejecting relevant findings on false grounds. City school principals, for example, almost automatically reject findings from rural settings.
>
> But we might raise the question, "How much of the burden of being skeptical and systematic should be born by the researcher?" If the researcher is too cautious, the public cannot find out about his/her insights. It is not possible for the researcher to assume too large a share of the burden, by refusing to draw in the experience of the reader.
>
> The case study researcher does not guarantee that the reader will have an equal share in the interpretation, but it is common for responsibility to be shared between case study researcher and reader.

We have provided yet another step to this process of interpretation in the assimilation chapters. In many ways the case studies stand by themselves. It is by reading the case study that readers have the opportunity to make their own judgments as to the adequacy of the proof and the degree of confidence to be assigned the statement in the assimilation section.*

Audiences and Indexing. In addition to multiple observers, multiple data sources and multiple authors as well as multiple topics, we have anticipated multiple audiences. Recognizing that our primary audience is NSF and their concern for the questions in the RFP did not preclude recognizing the potential interest in and usefulness of this report to people throughout the educational and scientific communities.

As the writing, analysis and rewriting progressed, the reorganization, modification and finally settling in of various chapters took place. It was during this process that the need for indexing of topics took on importance. Not feeling comfortable with saying specific chapters will be of interest to specific groups of people, extensive indexing was provided for readers to make their own selections as to what to read.

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*Writing the Executive Summary led us further than expected into "seeing" the larger social system in which science education is embedded. It inspired Jack Easley to undertake further research in this direction. (Details available from him personally.)

CRITIQUES

Critical reviews of preliminary drafts of this report had started to come in as this final draft was completed. Several of those reactions expressed concern about the methods used, and seem worthy of attention here. One reviewer said:

> You chose to include some observations in the summary and to exclude others. The basis for your choice in these matters would be interesting to know. That is, TRUTH could not be the criterion--because there are probably a number of truths that you did not include. For instance, my guess would be that the science faculties in secondary schools are male dominated. You didn't cite that TRUTH. You did say that the teaching is "text-book" oriented. Why the one and not the other? The reason might be called "bias;" that is, you were biased towards observations of the one sort rather than another and the bias appears to me to be basically unsympathetic to teachers.

There is of course a great deal of subjective judgment in selecting emic issues. We tried to include some of our criteria on page C:29. Given the people we observed, the organization which sponsored this work, and the audiences we anticipated, we tried to attend to what was meaningful and would be useful to them. We were also accused of being too sympathetic to teachers. Of course there was some bias on both sides in the eyes and words of those many people who helped shape this final report.

The National Science Foundation asked a panel of four to review the preliminary drafts. One of these reviewers, lavish in praise for much of the report, noted that the report would be limited in some of its intended utility:

> Thus, CSSE likely will be unsettling to conventional policy formation practices. It certainly cannot be the "fall guy" for actions taken by policy makers. CSSE, to the extent that it honestly portrays the reality of science teaching, does not present a rationale in favor of or against major policies. Policy makers may fault CSSE for its failure to portray reality correctly (although I believe that charge would not be justified).

Although we failed to review particular NSF policies in this research, and were not encouraged to do so, our findings are indicative of merit and shortcomings in past and present NSF policies. There is substantial support here for future efforts to help teachers directly, including a continuation of teacher training institutes. There is little support for a continuation of efforts to support curriculum reform or for new efforts to develop instructional testing activities. We could have made more direct statements of this sort, but we felt that such simplistic findings discourage review of the circumstances needed to accommodate a policy to complex realities.

A second reviewer on the panel concluded that the CSSE information "will not be useful to science, mathematics, and social studies professionals because the information is based on research with vitiating flaws in design and execution."

> Much of the writing in the case studies mixes facts, inference, and opinion with little warning to the reader. Little is said about how many teachers and students were interviewed, what the specific questions were, how many hours were spent at each school, and other obviously important points. What is more there is little explanation of how anecdotes and quotes were collected and selected. Since the complete raw evidence is not presented, one has to guess at how anecdotes were selected. Do they simply exemplify the conclusions and opinions of the authors? Certainly a single instance does not prove a point; and the instances are insufficiently numerous or explicitly cross-checked to build up a creditable generalization.

Whether or not this report will be useful to professional educators and others is an empirical question. The interest shown so far seems high, but that would not yet indicate that the information is of high quality.

This critic implied that a good research report is highly explicit in its description of researcher behavior. He presumed that this study should be judged on the basis of its contribution to science. He showed little sympathy for the claims we made in this chapter for the validation of observations. (It was an earlier draft he reacted to.) His standards are high, but his definition of educational research is narrow.

In revising this chapter we did not answer his questions. Except for one, his questions are trivial. Had we documented every moment, every interrogation, every possibly meaningful raised eyebrow and facial tic, we would have contributed to a methodologist's inventory, but we would have substantiated our findings little more than we did.

The final question, "Do they simply exemplify the conclusions and opinions of the authors?" is not trivial. It stood before us throughout the two years of work and it will continue to bedevil the authors. Chapter 19 does state our conclusions, of course, but are they sufficiently based upon representative happenings of science teaching and learning today? We do not know. We have insisted on looking at some issues that are too complex to be handled with standardized methods. We have insisted upon telling of rare instances that seemed to have special meaning. We have interpreted ordinary events in some unusual ways, knowing that others will interpret them differently. Some of our offerings did not lend themselves to what that reviewer considered "scientific."

Recently, Henry J. Aaron wrote* that

> policymakers or laymen should and do use research findings as only one among many kinds of evidence, including past research and commonsense beliefs, in deciding what public policies to support. They do not, and should not, apply the same tests of statistical significance commonly employed by analysts in testing hypotheses, but rather should act on the weight of all the evidence. The analysts can help raise the standards of admissible evidence; they can enrich and deepen understanding of the complexity of problems and the unintended consequences of action.

It seems less important to ask if these case studies met scientific standards than to ask if they added to understanding. Neither one depends on the other.

As we completed our work the fourth panelist had still not responded, but the third had this to say:

> The major advantage of this anthropological approach is that the researcher can become a participant observer of the phenomenon being studied. In these studies a researcher visited and lurked in particular school settings to document the status of science education. How better to describe what is happening in these schools! The disadvantage is that comparison and evaluative type statements cannot be made.

That is, to be sure, one of the trade-offs. A well-validated judgment or precise comparison is not available from such studies. The study cannot be the arbiter. As one of the other panelists noted, it leaves it up to the reader and the policy maker to make their own comparisons, interpretations, and policy decisions.

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*Henry J. Aaron, Politics and the Professors: The Great Society in Perspective (Washington, D. C.: Brookings Institute, 1978) p. 166.

Chapter 12

THE VARIOUS AIMS OF SCIENCE EDUCATION

Margaret S. Steffensen

Overall, in the sites we studied, science (in the sense of the disciplines of mathematics, the natural sciences, and social science inquiry) was seen as having a rather limited value for the student body at large. Providing a strong program of science through elementary school up to college admission for those students who will become the nation's future scientists was not found to be a high priority goal for school systems. However, the programs in physics, chemistry, and advanced mathematics, particularly for the brightest youngsters, were being protected tenaciously by teachers in those departments in most of the high schools.

In practical terms every child was expected to learn to compute arithmetically, to take a course in biology, and to know some basic geography and history. Many elementary teachers were encouraging the observation and study of natural and social environments, but few were meticulously developing conceptualizations. Some of the traditional high school science content was being introduced in junior high or even in a few elementary schools. There was little agreement (and little hope of agreement) as to what is essential as skill or knowledge--though a strong and vocal portion of teachers and others argued that a list of essentials should be established and set as requirements.

During junior high school, if it has not started earlier, a progressive segregation of students occurred. Some took pre-algebra, chemistry, and geometry courses. Other "fast learners" joined this accelerated group a year or two later. These courses opened the door to more advanced mathematics, physics, and the advanced placement courses--the pride of the high schools. The grooming of a corps of future technicians, engineers, doctors, nurses, and scientists began here--and apparently only an occasional voice raised the thought that such disciplines also have a usefulness for everyone.

Perhaps because the practical problems of maturation, health, and financial management are undeniable, biology and arithmetic were considered necessary exposure for all students. (Few were questioning traditional requirements, many were seeking additional skill--as opposed to subject matter--requirements.) Most science subjects were seen as needed only by subgroups of students, many of whom have highly specific goals. The intriguing and impressive efforts that some teachers were making to enrich this sparse general education goal were scattered, diffuse, and showed no signs of either congealing as an educational cause nor of gaining general support from the public. (This seems also to be the case in the universities and colleges.) In most places geography and history were required. Other social studies courses (some of which were scientifically oriented) were found to have little general support, the possible exception being psychology, an increasingly popular high school subject.

We heard about the pressures on science teaching and the lack of support for it during visits to different sites:

Site visitors (reacting to statement by teachers and parents):

> *I was amazed at the number of teachers who were not aware of the curricular developments of NSF and other groups.*
>
> *Science department monetary resources continue to be cut back.*

A RIVER ACRES Teacher:

> *A lot of our students drop out of chemistry . . . because they claim they can't handle it. I don't think the subject matter is that difficult. It's the background and not being able to adapt to the standards the chemistry teachers require.*

A teacher at our rural trial site:

> *I don't think the average elementary school teacher is really prepared to teach science.*

An URBANVILLE administrator:

> *I think there are other priorities that have pushed science out of the way. . . . In the last six or eight years, it's been reading that has been a top priority, because it's been a problem with the public.*

In our national survey, we asked superintendents, junior high science supervisors, and parents of seniors how they felt about slow students taking science.

Slow-learners should not be required to take a science course in high school.

	Agree	Uncertain	Disagree	Total N Responding
Superintendents	7%	1%	92%	73
Jr. Hi. Science Supervisors	6%	1%	93%	139
Parents of Seniors	25%	4%	71%	111

Clearly educators and most parents want all students to take some science, yet most were not supportive of changing the courses to fit those not bound for college.

There are, of course, many important aims of science and many important aims of science teachers. We begin the presentation of our findings from the eleven case study reports--amplified with site visitor team reports and tapes, and with national survey returns--by considering those various aims of science education.

UNDERSTANDING

Teachers of science, mathematics, and social studies informed us that they want their students to understand the subject-matter of those curricula. They meant that they wanted the students to become knowledgeable, able to read intelligently, ready to work through problems, prepared for the next learning experience. It was not only a matter of knowing the meanings of words and the relationships among concepts, knowing the steps to go through to work a problem, but also knowing what content and what problems belong to which field, that for example, an interest rate problem belongs to one domain and a trajectory problem to another, that these boxes and arrows belong to a computer-program flowchart and those boxes and arrows refer to a judicial process. They wanted the student to be able to do well on a test, whether the teacher's own quiz, a part of the state's educational assessment program, or an admissions test for college.

Test are public manifestations of understanding, but the more important to the teacher was whether or not in beginning a new assignment or in reciting in class the student shows to the teacher's personal satisfaction a comprehension of the topic.

Standards of personal satisfaction varied from teacher to teacher of course. And they varied among parents, just as among educational critics. The effort to set uniform standards of achievement had not progressed far. There were vast differences between what adults would accept as evidence that Johnnie understands science. Our observations of science programs in eleven sites did not tell us whether the children's understanding of science in these schools was excellent or poor--partly because this study was not directed at student achievement, but also because our standards were too subjective. What we have done is to report on the circumstances in these schools, e.g., that we have found the objective of "understanding" widely honored, conscientiously pursued, and regularly obstructed. The honoring, pursuing and obstructing are detailed not only in this section, but in all the pages to follow.

One aim of school programs is to share old understandings with new generations. Other aims are to prepare the students for later study, particularly in college; to prepare them for working; to acquaint them with the values of our society, particularly in the realm of the intellect. Our encounter with those aims is discussed in subsequent sections. In the following section we discuss the pursuit of understanding, particularly through the process of inquiry, ranging from more traditional inquiry (by readying textbook materials) to the efforts of curriculum reformers to make inquiry more parallel to the quest of a scientist on the frontier of knowledge, noting both the aesthetics of the search and the cautiousness with which evidence is accepted or rejected. These are all part of inquiry, part of the search for understanding.

Inquiry. In 1957 Max Beberman and Herbert Vaughan were creating a version of high school mathematics (UICSM) in which ambiguity of symbol was removed and which could be built on a nonverbal awareness of patterns in number problems and sets-and-relations. In 1959 Gerald Zacharias, Francis Friedman and Gilbert Findlav organized a version of high school physics (PSSC) which postponed the traditional opening chapters on Newtonian physics to midcourse, and opened instead with an exploration of the structure of the universe, followed by an exploration of wave motion, chiefly in ripple tanks. The demand in each case was that students think about patterns involving quantities and come to an understanding of fundamental principles rather than just concentrating on solving particular categories of problems. Thus opened the grand preparation for inquiry as an ethic in pre-college science education.

The general reaction to the idea and the materials developed in these two projects was that they were too demanding on students. A few teachers were enthusiastic, but the approach did not spread. Now, UICSM texts are out of print although "Pronumerals," "Frames," and other ideas they introduced continue to find a place in school math texts.* PSSC is still in print but was being used in only a very few high school physics classes in the eleven sites.

A science teacher at BRT, our rural Illinois high school, said (p 4:10):

> *I liked PSSC physics. You really didn't tell the kids anything. It was very inductive. With the group I had at a previous school it was very good. They were eight, bright, highly-motivated students. It's a risky text as to how much kids are going to get out of it. We decided here to go with something more traditional to try to reach a greater majority of kids. I've got useful ideas from those series. I still like the labs where you don't tell the kids what the answer is.*

In the opinion of many enthusiasts these programs were too demanding of teachers, requiring a rather drastic shift in ways of thinking about teaching as well as changes in teaching practice. Teachers told us that if students were to cope with these new textbooks and lab materials in the same way they coped with earlier courses in math and science (and in the same way previous students had coped) then only the very bright students would succeed. Students had ample acuity and spontaneity to see new patterns. They could adopt exploratory modes of thinking. But few teachers were confident they could make systematic inquirers of them. It took they said, a special kind of faith, a special patience, to draw out and refine what the traditions of schooling did not encourage. The early ideas met with too much resistence and early in the 1960s gave way to material-development based on other assumptions, e.g., Motion Geometry, Stretchers and Shrinkers, Project Physics. In various ways, however, some science educators tried to keep alive the idea of "inquiry" as an aim of science education.

"Inquiry teaching"--as contrasted with didactic, recitation, or discovery teaching --organizes its course work around the more important observations and questions students raise, stressing individual student follow-up and probes. Text readings and workbook exercises are subordinate to student search for understanding. One of the more important findings of this case study project was that, despite considerable contact with legacies of the NSF-sponsored curriculum projects and with inservice programs dedicated to the promotion of student inquiry, very little inquiry teaching was occurring in science, math, and social science in the eleven sites. Lessons typically were organized by teachers around printed or dittoed materials. Problems were worked by the students, following the example set by the teacher, who helped out when an obstacle was met, but who gave little encouragement to go beyond the problem or to question an implication.

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*Suzanne Quick reported a similar impact on science textbooks in her dissertation, "Secondary Impacts of the Curriculum Reform Movement: A Longitudinal Study of the Incorporation of Innovations of the Curriculum Reform Movement into Commercially Developed Curriculum Programs" (Stanford University, 1977).

(To our surprise, many observers reported little traditional "teaching" in which a teacher explains something that he or she understands and that the students are trying to understand, asking questions to find out what they do not understand, etc.)

On those rare occasions when our observers saw a teacher and pupils engaged in mutual quest for understanding, it seemed to occur almost by accident (cf. Chapter 16, the first section). Many of the materials developed to promote inquiry in children (MACOS, ESS, Cuisenaire rods, geoboards, PSSC labs, BSCS lab guides, etc.) were still there in the schools, often in storage or stacked in corridors, seldom being used. And when we saw them used, the atmosphere was typically one of "doing something needed, producing something, getting an answer somebody wanted." So seemed the case with a BSCS classroom in FALL RIVER, Colorado (p 2:6).

The teacher we found at the secondary level was not a "model inquirer." He or she tended to ignore details of the discussion, of the materials or data, which did not lend themselves to the scheduled interpretation. The students and their parents were comfortable, we believe, with the idea that the lesson was not aimed at raising a creative challenge or promoting critical thinking--but for discovering what others have discovered, understanding what experts have come to accept as standard conceptualization or theory. (See for example the lesson on thigmotropism discussed in Chapter 16.)

When we examined the most general statements of educational objectives for these courses and these school districts we found words that implied that it was important for children to inquire into their world. The more explicit statements of objectives indicated that it was important for children to know what had been learned by others who had inquired into matters of the world. The teachers for the most part explained that it was important first to get the basic skills, the vocabulary, the study habits, the arithmetic facts and all. Then, later, one could spend time wisely in more abstract and unstructured endeavors. Most parents agreed with this pedagogical and curricular commitment. Most students did also. A nation wide "back to the basics" movement seemed in many ways directly opposed to student inquiry. It appeared to suppress inquiry by "making sure" that students have been informed of the facts that they will need, to reach previously selected conclusions. The educational goals for most students, especially in senior high school, seemed deliberately narrow--for reasons that appealed to many diverse groups, reasons that will be developed at length throughout the remainder of this report.

The informal aims of individual teachers seemed to be a quiet but strong counterforce to this narrowing. Almost every science teacher had strong ideas as to what should be included in the curriculum, as to how the basics should be defined, as to what kinds of inquiry were good for students--and these ideas were continuing to be the prime determinant of what went on in that teacher's classroom. Still the teacher did take note of district mandates and more explicit statements of objectives. The teacher was increasingly aware of what was covered on standardized examinations and assessments, and increasingly sensitized to the poor scoring of his/her own students. Most teachers believed that you should teach interpretations and even inquiry in all classes in all the grades at the same time you taught the facts of knowledge and skill--as the following item from our national survey* shows:

> Some people urge a big push to teach reading skills and math facts alone at first. Other people say you need to teach lots of basic information while teaching the skills. Others say "teach analysis and even interpretation at the same time." What do you say?

26% of the 146 social studies supervisors responding said: "Teach the basic reading
36% of the 58 elementary school principals responding said: and math at first, the
57% of the 93 high school math teachers responding said: other things later."

14% of the 146 social studies supervisors responding said: "Teach basic skills and
15% of the 58 elementary school principals responding said: lots of content first,
17% of the 93 high school math teachers responding said: the other things later."

38% of the 146 social studies supervisors responding said: "Teach all those things
45% of the 58 elementary school principals responding said: together, all the time,
20% of the 93 high school math teachers responding said: in every grade."

A few teachers, in ARCHIPOLIS and BRT schools, for example, were forthright in their effort to encourage inquiry. In one school one of our site team visitors saw a class in which students were actively engaged in inquiry, with the teacher outside the interaction. The teachers in those scenes testified though that it was very difficult, the results seemed to come so slowly, they never seemed to know just the right questions to raise. They stated they had to prepare so much more for inquiry lessons than for regular teaching that only a small percentage of time could be spent in inquiry teaching. (The reader would probably find the remarks of the teacher at BRT much more revealing of the complexities involved. They start on p 4:10.) So they too became persuaded that much of the inquiry will have to wait until "later."

Work or Play. Science, as seen by many of the early curriculum innovators has a strong aesthetic dimension. Somewhat in contrast is the rigorous craftmanship of the traditional view of science: formulate a hypothesis, deduce observable consequences from it, test the consequences, draw conclusions. Zacharias and Friedman contradicted the convention by emphasizing "hands on" manipulation, an approach at times almost playful. (Put two fingers into the ripple tank. Generate overlapping sets of waves. Change the frequency to see if you can recognize a pattern.) The little motors that gave precise control over wave generation appealed more to many teachers, but those around "Zach" caught his enthusiasm for getting their hands into it. Philosopher David Hawkins called it "messing about." They saw the sequence reversed; first you had to scuffle with nature to try to see what was happening; the precise control of variables with neat apparatus could come later. Good science education might not only be the pursuit of one's own curiosities, it might be a bit capricious --so the new ideas went.

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*Percentages are weighted according to the RTI sampling plan. Standard errors are given in Chapter 18.

Later David Bohm, University of London physicist, reflected a similar view with his notion of actions as creative processes.* Jean Piaget was rediscovered as having a theory of intelligence flowing out of human action. Thomas Kuhn's book, The Structure of Scientific Revolutions, stressed the irrational aspects of consensus within scientific communities and paradigms for interpreting phenomena rather than the rational aspects of building theory out of data.** Teachers in the fifties and sixties, especially secondary science teachers, were exposed to these new ideas. Many of the ideas were caught up into the promotion of "inquiry learning" and "discovery teaching." A great number of teachers were aware, and many were hopeful--but the universal realization was that with the way schools were then (and still apparently are) an inquiry approach would result in good learning and good test scores only with the bright youngsters from intellectually motivated families.

Inquiry does not appear to work. As indicated in Chapter 16 we found that many teachers feel that higher level study is hard work, life is full of hard work, the children need to learn that learning is hard work. It should be remembered that, the science experience of most high school teachers was largely confined to the rather rigorous, authoritarian undergraduate courses in colleges and universities.*** In a few places an undergraduate student majoring in science might work on a research project, and in a few instances the project might be one where creative inquiry was apparent. We found few teachers in the public schools we visited who had had that experience.

About 50% of our surveyed high school science teachers, 30% of our high school math teachers and 10% of the high school social studies teachers had attended at least one NSF summer or academic-year institute. In only a few of these institutes did the new "aesthetic" view prevail. They told us they read on the average about seven professional articles and four scholarly books a year, and some of these did raise the issues of aesthetics in science, math, and social studies. But the impact on the teachers's teaching was apparently small. Science was something teachers "took" in college, (often did well in), but it was not something they experienced as a process of inquiry, certainly seldom a personal participation in inquiry. It was not surprising then to find that creative inquiry was not what we found in these eleven high school science laboratories--except in rare instances.

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*David Bohm, "Physics and Perception," in The Special Theory of Relativity (New York: W. A. Benjamin, 1965).

**See both Thomas S. Kuhn, The Structure of Scientific Revolutions, 2d ed., enl. (Chicago: University of Chicago Press, 1970), and R. E. Ripple and U. N. Rockcastle, eds., Piaget Rediscovered (Ithaca, N. Y.: Cornell University School of Education, 1964).

***On the dogmatism of science teaching and textbooks see: Dorothy Nelkin, Science Textbook Controversies and the Politics of Equal Time (Cambridge: MIT Press, 1977).

Anthropologist Jacquie Hill-Burnett, one of our field observers recorded this in ARCHIPOLIS (Field notes):

> A sample full day was spent in Junior High, with one of the two science teachers in the school, a woman of much experience including a summer NSF institute. There was no doubt, from her own claim as well as the nearly dreamy nostalgic way she described the institute, that it was a peak experience of her life. Professor XX of West Virginia University had taught her, and others, not only about science but about inquiry. And she returned to her teaching setting so inspired that she stayed late into the evenings in her classroom allowing and encouraging students to come back to work on science, particularly laboratory projects. She used IPS a great deal then; now she uses it with only one or two classes. The enthusiasm for extra laboratory hours was suddenly stifled by an experience reflecting the danger in the environment. One morning her homeroom class saw in the school yard of the elementary school across from their school a dead man lying there, shot dead the night before. It shocked them, students and teachers, into the realization of the dangers they walked among, just getting back and forth to her evening classes.

It occurred to us that there was more reason to expect that real inquiry would occur in elementary school science classes. Many college courses on methods of teaching science in elementary school have actively demonstrated and encouraged student inquiry. So did many special workshops for elementary teachers and many of the summer institutes for elementary school science teachers. In fact, we heard high school teachers at our sites complain that

> *elementary teachers do not really teach science at all, they just teach how to observe.*

But we found little inquiry, little of the aesthetic view, little "messing about" in the elementary schools either. The problem here apparently was that many teachers, particularly in the upper elementary grades, did not feel they could afford to allow children to engage in such undisciplined, unproductive behavior. They were not somehow protected by the scientists, historians, and philosophers who testified that--even ideally--science was actually not so rigorous and disciplined, certainly not as much so as presented in textbooks and in university courses. Perhaps against the pressures of parents and teachers-up-the-line, these teachers felt obligated to more work-like activities.

As it became apparent outside the classroom, even a national embarrassment, that many children were not learning very much in school, teachers looked for ways of improving the performances of the poorer learners. The words "structure" and "structured" became frequently used to describe what teachers felt was needed. These terms usually referred to the directions teachers (or the authors of materials) gave for students to follow. It turned out to be a "persuasive" definition. But interestingly, it countered Piaget's use of the term "structure" to describe the developing organization of ideas in children as they manipulated objects in their environment. Piaget's observations that "structure is natural" were interpreted to mean that "structure is necessary", and researchers discovered that certain children lack the "structures necessary for learning science" and presumably, have to be "given structure" or "taught structure" so they can learn. Realization that knowledge is structured, that good teaching can be structured, and that cognition is structured probably does not justify the belief that learning activities should be more structured than they have been, that they should be less open and aesthetic, or that they should postpone inquiry until certain prerequisite structures are in place. But we found the anti-inquiry work-ethic belief in "structure widespread.*

Empiricism. We found little reason to believe that school science teaching aims to develop an appetite for submitting beliefs to empirical test. An overriding concern in most science instruction was for students to arrive at the "right" conclusions. Getting there may have been primarily due to the charisma of the teacher, or to the faith of the student in science, or to something else. Interviews by CSSE staff member Jack Easley revealed repeatedly that students were tuned to pick up the cues teachers gave as to what was the right answer and that teachers were strongly bent on sharing the factual information, definitions, or general principles taught earlier to them.

Most science teachers felt that the emphasis on facts and techniques has been about right. Junior and senior high school social studies teachers tended to say that there has been too much emphasis on facts, not enough on concepts. But parents tended to say just the opposite (see Scenario Y later in this chapter) opting for a greater emphasis on teaching the facts.

At ALTE, a prestigious suburban high school, we observed several teachers pointed out as highly qualified by the principal and department heads. It was clear that they carefully planned and used data and arguments to support "the accepted theory." Never once did anything that would support alternative theories get a nod. (In social studies classes non-standard or unpopular views sometimes did get acknowledgement.) These excellent teachers were explicit in their teaching that science is tentative, that the scientist is ever a skeptic, that evidence rather than faith is the basis for knowing. But, just as the elementary teachers mentioned earlier, there was so much to get done; one usually must hasten past the doubts, the options, the weakness of the evidence.

We talked to students and found that doubts were there, even in those who had the greatest understanding, even among those who had the greatest inclination to accept whatever the teacher said. Would it be possible for science to be taught so that their own powers of inquiry would be more effective against the doubts? Did we pick up any clues about that? Not directly, but we connected a growing point of epistemological thought with the frustration expressed by some students, namely that science was too abstract, too contrary to intuition, too irrelevant to life's problems. (An URBANVILLE youngster wanting to become a ski instructor couldn't think of any reason why he should take physics.) Based on the work of Piaget, Bohm, and others, the view is that new knowledge and learning is fundamentally based more on a mixture of action, personal experience, and old knowledge than on a correction of old knowledge by new information.

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*This instructional structuralism appears not to generate more fundamental opposition to scientific inquiry than the various religious and spiritual movements which traditionally have opposed it. See, for example, Edward Shils, "Faith, Utility, and the Legitimacy of Science," in Science and Its Public: The Changing Relationship, ed. Gerald Holton and William A. Blanpied, Boston Studies in the Philosophy of Science, vol. 33 (Dordrecht, Holland: D. Reidel Publishing Co., 1976). Theodore Roszak's "The Monster and the Titan: Science, Knowledge, and Gnosis," Ibid; & Gerald Holton's "On Being Caught Between Dionysians and Apollonians," Ibid. "This kind of resistance does not go far enough to solve the problems of a future safe from the perils of technology," said Don K. Price, former president of AAAS.

Propositional evidence presented to support a conclusion is less convincing to a dedicated scientist or a tenth-grade biology student than action performed by themselves to generate understanding of the conclusion. Scientific conclusions and personal understandings of science were apparently often considered implausible by students, not because of any evidence against them, but because the student cannot imagine or carry out the active process postulated. Classic examples of phenomena difficult for students to comprehend as actual mechanisms or processes include evolution (How can the missing links all have been adaptive?), and chemical equilibrium (How do you get ratios of concentrations from an image of a molecule separating and joining again?) Do lessons on these phenomena mainly teach that one must accept science on faith, that there is no personal action by which the scientist or student can verify the propositions?

The scientist, teacher or author who presents the principles of such concepts as believable because of the evidence for them is not involving the student in the evidentiary, empirical process, but simply giving assurance that the authorities are checking on the evidence. The models, images, and gestures used to understand these concepts appear to lack the generality of the principles and the evidence: they are idiosyncratic. They are often atypical cases and models which, by logical processes, have no persuasive power. However, the psychological power of actions to persuade belief is great, indeed almost too great for action models to be trusted; contrary models and mechanisms can be imagined with equally persuasive consequences. Yet the history of science is sprinkled with periods when it was only a kind of intuitive feeling for a model or mechanism that "held the fort" for an innovative theory until the data could be marshalled to support it. Unfortunately, this approach seems to be out of reach for most teachers--it flies in the face of scientific tradition. CBA Chemistry, which was one of the few serious efforts to communicate the images of models (though not much process of the action sort) is considered much less scientific and harder to teach than CHEMS. That is the way it is.

As we discussed these observations with professors and supervisors of teachers of science we found interest, hope, and despair. "If only science teachers knew more science!" "If teachers were only better at inquiry themselves!" "If they only accepted evolution for its factual support and explanatory power instead of as authoritarian dogma!" Such off-the-cuff reactions, however, failed to touch the reality of the life of a teacher in the classroom. In VORTEX Pennsylvania a curriculum coordinator said (p 10:10):

> *Teachers are experiencing difficulty with the inquiry approach--and we simply don't realize what it means when we suggest to an instructor that she needs to change her classroom practices."*

As we saw it, teachers and students were caught between parents and scientists. There was much on which they agree, but much on which they disagree. Teachers could not confront too many at a time. Some expected bad reaction in class if they admit personal or epistemological fallibility. They sensed antagonism from pupils pressured to have "the answer." They cling to their social rank, their podia, their seats of judgment. To give up their authority, to give way to "nature," to honor the pupil who has a profound but contrary thought, or to accede to the antagonized parent would be to lose the larger battle for the socialization of their pupils, to lose the respect of their colleagues, and perhaps even to lose control of the classroom.

An inquiry component to a curriculum would continue to be welcomed by some teachers. Action-based or process models of scientific concepts will continue to be appreciated by some students. They need to be assured that the evidence will be presented competently, that the inquiry and the activity do not leave the understanding of the phenomenon an oversimplification; that the activity has merit more than its power to amuse. Teachers are delighted to have student interest, but the teacher must feel comfortable with the admonition, "This is good for you--do it."

The aim of some science instruction is to make youngsters more self-sufficient in their inquiries into science. That aim was getting low priority in the schools we visited. There was a reliance on authority, a need for locating that authority in teachers and the school system. As a pedagogical device, that role of authority does little harm to scientific inquiry. The rejection of aesthetics and personal empiricism may be doing more to subvert inquiry as an aim of science education in the schools.

A Vignette of Inquiry. The ideal of the inquiring student, ruminating, probing, checking the alternatives, stretching his/her mind is inspiring--the actuality is likely to be chaotic and tiring. The youngsters do not put aside their personal feelings and social proclivities in order to ponder. They "mess about" with questions like "Who are going steady?" and "Who bought that new pair of skis?" Helen Simons, a site visitor brought in the following report of a Peas and Particles lesson from E.S.S.

> . . .Each group had one or two pictures of a batch--of nails, fish cans, people, etc.--and a short list of questions on each. The teacher was sitting with one group engrossed in their problem. I joined a second group of 3 girls and 1 boy. Their first picture was rows of fish. Their first question: Was it a day's catch or a week's catch? The boy was vigorously counting the fish one by one.
>
> They did not concentrate for very long on anyone's suggestion. They often did not listen to each other, repeatedly asking for the question and reasoning of the others to be stated again. (The girls giggling suggested that they may have been distracted by my presence at first, although later they spoke to me as a member of the group.) The boy seemed put out by the tape recorder. The girls indicated that he always fooled around. They were irritated at having him in their group and occasionally spoke very sharply to him indicating that he had not been listening and was holding them up. Five minutes before the lesson ended they got angry, "If you don't help us. . ." "If you're talking then you're not going to get anywhere." As the girls tried to reason out the fish question, he kept trying to be heard. When not listened to, he would offer his own idea, counting over the top of their voices or guessing. The girls were not actually solving the problem collectively either. Each was simply offering her thoughts on the question. After a few minutes of observing, guessing and counting, the girls decided on the first answer: a day's catch.

They then hurried to the next question: How many fish are caught in one week? The boy started counting. One of the girls started also. Both got to seven when a second girl (one of the advanced group) offered a solution:

> *Seven times how many fish. Just count the one row. Count one row at a time and seven times how many in that one row.*

The first girl said, "That's it". But the boy pointed out that the picture cuts off and there were more over at the far corner of the picture. Second girl again, "You could count two more for right here," (pointing to where the picture fades away).

Third girl starts counting, "1 2 3 4. . . ."

First girl interrupts, "No, not there, right here in this row because you can see this whole row."

Boy continues counting. . . .gets to 19. . . .

Second girl ignoring him, "Some of them are close together. You've got to count all the fish."

Boy still counting one by one. Now at 36.

Girl 2 murmuring, "How can we be sure. . . .that's what I'm saying. . . . better count them all." At this point the first girl says, "Let's make an estimate. . . . I think it's about a hundred." Then she modifys it to 65. The boy says 70; another girl immediately 71, a third 97. For the next few seconds they argue over the estimate. The second girl taking the initiative in deciding that 100 should be multiplied by 4 (since there are 4 rows) to give the number of fish in one day and by 7 to give the number of fish in one week: 2,800. The others rather desultorily try to check out that answer. They don't seem convinced but let it stand.

They start to solve the next question: How many pounds do the fish weigh? by guessing how many pounds one fish would weigh compared to one they are familiar with. They argue between 3, 4, 5, 6 pounds, each trying to assert his/her approximation as the one to go by. Eventually the first girl concludes that they weigh 8,400 pounds. She has taken the second girl's estimate of 3 pounds (dismissing her own of 5 pounds) and multiplied the number of fish in one week, 2,900, by 3. The second girl asks if she is sure, checks the answer. Third girl says that she checked it too. All write down 8,400. First girl says, "That's nice," with satisfaction; second, "What's next?"

The second girl to speak is most assertive throughout. She is also the most thorough, insists on checking before leaving the problem and more often than not comes up with an alternative way of looking at the problem. The others accept her decisions.

They move on to a new picture: paint cans on shelves in a shop; the question: Can the size of the paint can help you estimate the total number on the shelf? Their solution starts negatively. They seemed tired. (It is approximately 25 minutes into the lesson.)

Girl 2: *Let's just put no.*

Girl 1: *Yes. How many?*

Girl 2: *No, they can't.*

Girl 3: *No, I don't think so.*

Boy: *She wouldn't have asked that question unless it was on a theme. (He starts counting.) 1,2,3,4,5, 6,7,8,9,10. . .*

The girls don't seem interested in this problem. They contradict whatever the boy says. He goes on counting. Gets to 20. First girl says, "I don't understand this at all." Boy continues counting to 42. . . girls giggle and laugh. Boy concludes of one shelf, "This is 40." "No, it isn't," says the second girl impatiently. Then she suggests, "Let's estimate." He retorts, "Let's just count." "O.K.," says the first girl.

Second girl says, "Oh. . .oh! there's a fat can here. . ."

Third girl by this time is also counting. . . .27. . . .30. . . .38. Everyone is counting!

Second girl exclaims, "Ha Ha! there's 38."

First girl repeats, "I don't understand this," and appeals to me for help.

I was reluctant to intervene as I was interested in seeing if they would get beyond counting. But they had shared their difficulties and were obviously frustrated. I said that I was just wondering if there was another way to do it. . . maybe instead of counting. . .

Two minutes later the teacher comes over to tell us that the group she is with came out with "something really great" which she says they will tell us about in five minutes. I feel I should have helped this group further. The second girl responds to the proposed ending of the lesson by pushing for an answer to the paint can question. But by this time the teacher's voice is dominating all the groups who are talking at once and this group fragments, leaving the first and second girl struggling. They decide as they had before that estimating is easier than counting. But they have not answered how or why.

Fifteen minutes before the end of the lesson proper, the teacher assembles the groups around the blackboard for each to share how they solved their problem. She encourages them to talk through their difficulties by first admitting a mistake the group she was with had made, "We made a big generalization which we found did not work." She followed up with, "Whatever you found out, let's hear it, whether it was a success or not. We don't care."

She asks John to share his group's problem first. John is one of the brightest and one of her favorites. She commented to me afterwards that he never leaves school before saying goodnight to her personally. "He's the only one in the whole class who does that. I told his mother. . . it's so cute of him. He's such a darling kid." Not so darling according to some of his classmates. (Some report, "He doesn't control his arrogance," though they acknowledge his "brilliance.")

John's picture was the mass of nails. He offers his explanation in a very confident manner. The teacher keeps interrupting to ask clarificatory questions, opening the process up for the rest of the class to follow. What he did was to take a small square piece of paper and place it in the middle left hand side of the large picture. He said he did not know how big the square was in answer to the teacher's question, but he measured that there were 100 nails inside the square. Then he placed the square over the rest of the page and found 367. He then multiplied 367 X 367. The teacher summarized: "You counted the number of nails in this direction and the number of nails in the other direction and multiplied one by the other. Now what did you get?"

"134,629," he announces. The teacher suggests they round that up to 135,000 and then asks what method of measuring he had used.

. . .

Later the observer commented:

> Two things in particular puzzled me about the lesson: John's use of quantitative analysis and the students' understanding of the processes they or the other group used, or might have used. I did not hear the student who spoke before John mention the term quantitative analysis. I assumed that the class must have been taught this (and some understanding of the other processes) before, or John had special mathematical tutoring.
>
> When I asked the teacher afterwards what knowledge the class had of the methods of measuring and what introduction she had given she said:
>
>> *"Nothing. They did not know anything about it except that I just put volume on the board. . . I didn't tell them. . . they just figured it out. . ."*

Then she qualified:

> *"Well, they know what a binary is. . . well, some of them know about volume. . . and we work with weights. . . they know about quantitative. . . we work with analysis. . . and solutions."*

> She went on to say that when they had finished the unit they would know about measuring, volume, area, mass, sampling, ratio. She also said that it was the first time she had worked with E.G.G. and she was experimenting with it. She intended to try it again, integrate what was best into her own approach and leave the rest.*

It is easy to see how many teachers prefer to have children learn about making estimates by reading about how an experienced estimator would do it or the principal steps one should take in estimating. They of course may be right.

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*Further comment on this vignette is on p 16:17.

COLLEGE PREPARATION

> Overall, Tony, a GREATER BOSTON senior, feels there are a lot of opportunities for students at the school, but that you have to push to get them. Through the flexible campus scheme he is taking a calculus course at a nearby State University, but he says he had to keep reminding people at school about the course in order to get in. "At my last school there were about twenty counselors, and they kept at you all the time to get college applications in. It was a school where most students went to college and the school was all geared up for it. Here there are only three or four counselors and most people are very busy. It means you have to do a lot of things for yourself" (p 11:39).

In GREATER BOSTON we found the high schools oriented more to the colleges than to any other institution or enterprise, just as the junior high schools were oriented to the senior highs, and the elementary schools to the junior highs. We did not find a high degree of articulation (see Chapter 14) or a strong sense of course sequentiality, but the teachers thought of education to a great extent in terms of their own experience (consider Mr. L., a long-time math teacher at rural BRT, p 4:27) and, of course, college was so important to them. The strong orientation to college was true even for schools such as this one in GREATER BOSTON where fewer than half of the youngsters would go on to college.

A Preparation Ethic. The purposiveness of the schools, upon close examination, did not seem to be simple, well-focused, or well-coordinated. But its roundness and tentativeness was very much in tune with the nature of the youngsters there, and with the sensitivities of the teachers, for they knew that most youngsters would not be settling into life-work or even social commitments until they reached the middle twenties. This distressed many parents, who knew that there is so much to know, so much preparation needed for a successful professional career. It distressed many administrators who would like to organize instruction in the most rational fashion, where purposes were explicit and progress toward those purposes properly quantified.

A considerable rhetoric of purpose thus emerged--statements of goals, criterion referenced testing, career planning exercises, counseling, accountability--all of which related to the responsibility of the schools to provide maximum service to students and taxpayers, but which was frustrated by the fact that young people do not know what they will need, nor do more experienced adults. The kind of education that is most appreciated anywhere is never easily explicated. (Even with the purposes the schools do have, the most suitable methods of attaining them are seldom clear.) What we had then was an institution that wanted to be purposive and efficient, but which was more a holding pattern than factory, keeping youngsters safe, increasingly encumbered with "responsibility" and exposed to the ways of the dominant society during childhood and early adolescence.

Perhaps the most frustrating aspect to this was that some of the children were not learning to read and write, not only at levels admired by college professors and social critics, but at levels they and their parents had come to believe were guaranteed by the district. (They have come to believe it because educators and politicians have promised it.) Thus the rhetoric of the schools in recent years stressed the purposes of gaining minimum competence for all youngsters, not as a response to, but simultaneously and in concert with the public yearning for a return to the "basics."

The formal talk was about the basics, about minimum proficiencies, but the informal talk, and much more of the striving, in the schools continued largely to be oriented to college preparation, or preparation for something likely to come. Certainly, eighth grade is likely to come after seventh, so there was a great deal of talk about getting ready for what the eighth grade teachers were going to insist on. Since students and teachers were moving around quite a bit and there had not been a great deal of uniformity across classrooms, there was not much actual structuring or constraint on the immediate studies. Course work could be pretty much what the teacher believed was best for the youngsters at the time--but the talk was there. This responsibility to socialize the youngsters to purposiveness, to preparation, to work, and to rationality is discussed at length in Chapter 16.

The most vivid statement about "a preparation ethic" was written by Terry Denny in his RIVER ACRES, Texas case study. The section (p 1:13) closed with:

> That mathematics teacher spoke for many, many others in the sciences and social studies as well. She works hard at trying to prepare her students and by her own admission is not making progress as the years go by. It is a hit and miss proposition. But the target is clear. In RIVER ACRES the junior high school curriculum arrow points in one direction: to Central High School. What the students have been getting ready for is variously described as "the big crunch, algebra"; "where many of the Latin [Mexican-American] students will meet their Alamo"; "the Rites of Academic Passage [re college]"; and "the end of preparation and the beginning of the real thing."

Responding to our national survey (reported on p 14:31f) junior high teachers were strong in their endorsement of preparing for the year ahead, somewhat more so than elementary school mathematics supervisors. (This orientation may be partly due to the fact that many junior high teachers were trained to teach at the secondary level.)

The College-Bound. Tammy, a junior at BRT told observer Alan Peshkin (p 4:49):

> *Next year I'll take sociology and psychology. I need them because they're useful for being a psychiatric nurse. Any course I take is for my own personal interest or for college.*

In all our CSSE schools those students who clearly were headed for college were provided with special courses in science and mathematics and sometimes social studies. Observer Mary Lee Smith reported on mathematics from FALL RIVER (p 2:10):

> Students follow three tracks. The most difficult consists of geometry, algebra II and trig, math analysis and advanced placement calculus.

Students not bound for college were not excluded, but the courses did not exist for them.

In several other CSSE high schools advanced placement courses were offered, entitling the student to special credit in college if the college was willing. At most colleges and universities it meant opportunity for the student to begin on a second or even third level in the sequence of such courses. The high schools were proud of these advanced placement courses and staffed them with some of their best teachers.

Gaining admission to college was not at all difficult, if the student was not particular about which college to attend. Failure to take or pass a certain required course could be made up by community college enrollment, available conveniently and relatively inexpensively to most youngsters living at home. Gaining admission to a prestigious or popular university was more difficult, even moreso to pick the area of major study at that school. If a subsequent enrollment in professional school was part of the plan, then parents and student may have fretted about the high school grade-point average.

At some schools maintaining a high grade-point average in high school and having a high school record which included several science courses was not easy to accomplish. According to our survey a third of the students and teachers thought it more difficult to get good grades in science than in other subjects. See BRT (p 4:5) for a description of a teacher who consciously made his science classes an exception to this trend.

Getting a good grade was the primary goal for many students who intended to go to the colleges of status and prestige. For some students the risk of getting a poor grade outweighed the potential value and interest of the content of science courses. The impact of grade consciousness was indicated in the field notes from observer Lou Smith regarding a biology teacher in ALTE (p 3:67):

> In recent years, a shift in kids from quantitative biology to general biology--four sections vs. six sections. Used to be the reverse. She attributes it to lower parent expectations and the fact that an able kid might get a 3 or 4 in general biology but only a 2 or 3 in quantitative biology. The kids want the higher grade average, regardless of learning, for the college admissions race.

Even students in the science courses seemed not so much attracted to the content as to the more certain prospects of admittance to colleges of status and prestige which required more high school science courses for admittance. The college bound students were extremely aware of the value of the grades and seemingly less aware of the value of the content in science courses. More discussion of grading is presented in Chapter 15.

A "prep school" attitude was common in schools like Hardy High in URBANVILLE where a majority of students go on to college. There the assumption was strong that the faculty was there to prepare their students for college. In a VORTEX site visit report (Weller):

> However, despite disclaimers to the contrary, City High is still a college preparatory school. The community expects it and the teachers and administrators still see themselves in the old image. Though teachers claim they have much freedom in what they can teach and how they teach it, they still orient their required courses toward academics to prepare students for college.

> For example, when I asked a chemistry teacher if she had any messages for the NSF, she said, "Survey the college chemistry professors to find out what they want us to cover in our high school courses." Or, a biology teacher commenting on what he teaches in Biology I, theoretically a required course: "We know what kids going to college are going to need in college." Or, an environmental science teacher: "Environmental science should be an elective, because kids going to college need basic biology as a prerequisite."

Parents supported this form of preparation (p 1:81):

> *The mid-sixties found chemistry looking more and more like physics. Our first-line chemistry course is loaded with mathematics. Some teachers want to change our second year chemistry course to emphasize oceanography for example. Parents say "no"; they need solid chemistry to get into and do well in college.*

Mr. L. had been teaching math in BRT for twenty-two years. He said (p 4:29):

> *What I like best about teaching is . . . when I get students who perform well, especially if they carry on beyond high school into college work.*

ELITISM

In the science departments, especially with those who teach physics and chemistry, and to a lesser extent in the math departments of the high schools, we found an aim to be the best. It was an effort to excel, to get the students to excel, to be the elite of the academics in that school and compared to other schools around. The drive carried with it that search for prestige, that inclination toward exclusivity, and even an expectation of special privilege, that is often associated with elitism. We did not find this among those who taught government, geography, psychology, perhaps a bit among those who taught history.

It seemed that this was not just an aim that accompanied the teaching of science and math, but even transcended it. The claim will be made in Chapter 16 that there were times when subject matter aims yielded to socialization aims as the purpose of the instruction. A teacher told us:

> *Elitist? Of course I'm elitist--I'm here to teach the elite of this school. If they disappear so do I and the physics class. You want to know why physics classes have gotten smaller in the past few years? It's because parents have become anti-science and they don't want their kids to be part of the science elite.*

Whether they approve or not, parents we met recognized the special drive for excellence and exclusivity. A parent of a college-bound youngster in FALL RIVER said (p 2:7):

> *I've been very disappointed with the district for watering down the courses. There used to be a really strong physics program [with PSSC], but then [the teacher] decided he needed to*

> *accommodate the low to middle achiever so he threw out the good program and came up with this other one that is less comprehensive. It really hurt the well-motivated kids.*

And in URBANVILLE a parent of a youngster unlikely to go to school beyond high school said:

> *I think it would be all right if students didn't take any science at all at the high school level. . . . There are a lot of things kids are never going to use again.*

Some teachers apparently helped encourage this attitude of exclusivity, intimating that science is not important for everyone because it is something that is not needed in the everyday course of events. Science is important for those who are going into technical or scientific careers, they implied. Many mathematics and science teachers added to this feeling by setting absolute standards of excellence or standards relative to what they learned in college or elsewhere rather than relative to what the students in their classes could and should do. Some say:

> *Science is tough. If you don't have the mental equipment, you won't be able to understand it.*

This may be true, of course--but the message also was that it is all right for science to be exclusive, concerned primarily with the education of the more gifted or highly motivated students.

Questions 6-12 of Scenario Z of the national survey were drafted with attention to the issue of elitism in pre-college science instruction. The response indicated that teachers, counselors, and students saw much of the science program as college-oriented and saw some need for more science courses as general education. Details are reported on pages 13:15 and 18:81.

In most of the high schools we visited we found physics occupying the pinnacle of prestige among subject matter areas, with chemistry taking second place. Biology took a lower station, partly because of the greater commitment to general education, the need for providing the required course for graduation, and perhaps a greater concern for getting students ready for the biological responsibilities they will face in life.

In mathematics, Algebra I, geometry, and Algebra II were considered prestigious, with only the brightest enrolling in all of them. The high status of these courses was reflected by some parents "pushing" a child into them even though the teachers thought the child insufficiently able, interested or ready (see RIVER ACRES, p 1:79).

Elitist aims appeared to begin with instruction at the high school level, possibly some in the junior high. Science and mathematics were taught in elementary schools without the air of prestige and exclusivity. An elementary teacher spelled this out the opposite for science (p 1:35):

> *I feel science and social studies give us the one place in academic schooling where the lowest kid can really participate in class. There are so many things that can be done that are fun for children of all ages and abilities.*

Children at this level seemed to share this teacher's view of science. In the lower grades it was a popular subject, even though not emphasized as much as language arts and arithmetic. In the upper grades, science became somewhat more formalized as a subject matter, no longer easily lumped together with the social studies, and less often considered "fun for children of all ages and abilities."

The social sciences did not occupy a position of prestige in the schools we visited. We found a disproportionate enrollment of students who were not academically strong and poorly motivated in the social science elective courses. (See a discussion of this in the BRT case study, p 4:39ff.)

Commonly occurring with an elitist view of instruction was the use of prerequisites and a mild form of tracking. By having more homogeneous grouping, the teacher said he/she could adapt the material more closely to the ability of the students. Heterogeneous classes were more difficult, sometimes even nearly impossible to instruct, the teachers believed--and we had little reason to doubt it (RIVER ACRES, p 1:89).

> *Mis-assignment is detrimental to my teaching. With the size of classes, mixing the levels would be disastrous. Teachers are human. We respond to students who listen to us and ignore the lazy and disruptive ones, even if that's unfair to them.*

The drive for homogeneity can be so strong that, once established, it continues to press on and on. In RIVER ACRES (p 1:61) we were told:

> *We all prefer four levels to three. The "bad-news fours" could [then] be isolated. Now they contaminate.*

The RIVER ACRES case study is an excellent source of views on tracking and grouping. Difficulties of teaching heterogeneous groups and a conflict between desires for ability grouping and desires for equal educational opportunity for all youngsters are discussed in Chapter 14 in this Booklet XII.

The seniority system common in these schools supported an elitist view of science instruction. The most experienced teachers migrated to the brightest students, while young and inexperienced teachers, those whose teaching preferences were last to be honored, were assigned to the least able. They were teaching where teaching was the most difficult and demanding, and where they were the least able to cope. A social studies teacher said (p 1:121):

> *A new teacher comes in, is all idealistic about these slow students. They have come out of these education courses where they are all idealistic about these students without realizing what they really are like, . . . what their home life is like. You've got to take that into consideration. I mean you can't expect a lot out of those students if you go and look at the homes they live in. No wonder they can't read. You see, you as a teacher can't change that. You've got to accept it. If you're going to help them, you help them before first grade.*

Setting aside the defeatism, the message about elitism of some classes, of some teaching, was clear. A new teacher working with lower level students in RIVER ACRES (p 1:117) said:

> *The lower level kids are almost never taught by the better teachers who have been here for three or more years. . . . By the time I get the experience I need, I won't be teaching the lower levels.*

The youngsters knew who the better teachers were, who the more prestigious teachers were. They knew which students were apportioned the best things the schools had to offer. Certainly it was not only the physics and Algebra II students--for the basketball team, the children of the well-to-do, the youngsters who liked to help teachers, and special others, were awarded special privilege too. Our observers could not but help admire those teachers who tried to get scholarship rewarded as highly as anything else, but could also not help but reflect how easy it was for the aim of excellence to become the aim of exclusivity, and to transcend the pursuit of knowledge and understanding.

VOCATIONAL PREPARATION

In addition to the search-for-understanding and preparation-for-college, science education aims to prepare youngsters for work--or at least for vocational training. For this aim, science is often closely identified with technology.

The preparation ethic discussed in the previous section is pertinent to what is said in this section too. For us there is a need to know the purpose of something. One visitor from Europe asked, "Why does it matter whether anyone uses long division?" And we may not have a good evidence, but we will have an answer. In the schools we studied there was a strong sense that what mattered most was what would [illegible] in one's next studies, and that those, or the ones after those, were rel[illegible] would be doing on a job.

This vocational orientation of science education is consistent with several ideologies. First science in secondary school is often seen as an elitist program intended not only for being the best in scholarship but the best in professional endeavor, e.g., engineering, medicine, actuarial science. Second, it reflects a pragmatic American culture, valuing what is essential for making a living, keeping one's possessions in good repair, etc. And another view links science with vocational preparation through an analytic epistemology, breaking down knowledge into its pieces; the facts, skills, procedures and components.* The elitist, pragmatic, and analytic somehow join forces to authenticate the study of science in the American schools as a proper vocational effort.

As we said above, what mattered most (in the eyes of the people we talked to) was what could be used in one's next studies, and that it ultimately would relate to work. But what mattered most did not necessarily matter enough. We found considerable resistance to the idea that science is preparation for work. In URBANVILLE, one high-schooler put it this way:

> *I feel to really help you make it in this crazy world of ours, you're going to need practical stuff--business, things like that. Like typing, that comes in handy all the time. I feel that if*

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*One argument is that if knowledge is treated as a collection of pieces, rather than as ideas or models or metaphors, then the vocational relevance of courses can be controlled with the irrelevant pieces trimmed away, or never acquired in the first place.

> *more people take business classes, they'll do better; have a better opportunity. When you do get into higher math and science stuff, sometimes you feel unless you're really going to continue and be a physicist or something, there's no reason to take it because you're never going to use it. Unless you're really planning on climbing the ladder and be 'way up there. It's practical to stop.*

This view was shared by many adults. The vocational motivation for studying science may be becoming more complex. Our observer in VORTEX, Gordon Hoke, reported (p 10:8):

> Interactions with students suggest that reasons for taking certain courses are changing--that is, math, science, and the social sciences are seen as tools for eventual careers or jobs in health and medical fields, in other realms of social service, as a means of understanding self and others, and not as a prelude to becoming a mathematician or scientist. The number of extra-curricular activities identified with social services is increasing and students are aware that for them the "services society" means jobs as well as higher taxes for their parents. A senior in chemistry noted: "We've started a medical/health careers club and have about fifty members. There's a lot of interest." In response to a second question, he responded: "Because of prestige, money and jobs."

Financial payoff was widely recognized as a motivation when choosing elective courses or in establishing the proper level of commitment to subject matter. Some students denigrated their teachers because they were poorly paid. A RIVER ACRES senior said his parents did not know the difference between Jacksonian and Jeffersonian democracy but they earned a lot more than his teacher (p 1:114); see BRT, p 4:4, for similar statements. The implication was of course that he did not need to know to succeed either.

Teachers recognized what they were up against:

> *Salaries, obviously they're going to be a big incentive to students and not many see it's going to pay them to spend the extra time studying science.*
>
> *I've taught social studies. The kids look on it as not really necessary. Even in U.S. History they ask what good it'd do [them] in making a living (p 4:4).*

Teachers felt the tug of these material ambitions personally. At the trade school in PINE CITY, we were told:

> *It's hard to see a boy that's been out of school two years and come back and show you pay stubs that would exceed yours on a monthly basis by 400 or 500 dollars.*

But the above were not the views of the majority of teachers, students and parents. It was much more common for us to hear a teacher speak with pride in his/her courses, confident that they were relevant to the kind of thinking needed in vocational pursuits. One told us:

> *I push the kids more to take chemistry than I do to take physics because I think there are more vocational areas they might be interested in where they're going to need chemistry.*

It was common to find students who were satisfied that the vocational relevance of the courses was there, but not made very obvious to them. A young fellow named Dave in PINE CITY said (p 6: 38):

> *I knew by ninth grade I wanted to go into criminal justice so I found myself asking why biology? It's a question a lot of students ask themselves. Why science? And it's not a question that school really answers. I think teachers need to bring out the practical uses of the subject more. That would help . . . though I don't know to what extent.*

The fact that parents spoke highly of the vocational purpose of schooling should not be interpreted that they felt that it was not now so aimed. What they apparently wanted was a more effective course of study, not a different course of study. They had seen the youngsters of the community going into nursing, sales, office work, and they were reasonably comfortable that the things that were in the curriculum were vocationally relevant. What seemed to bother a great many was that too often the courses were not taught well enough to some youngsters to make them vocationally "ready" upon graduation.

Where the Jobs Are. The vocational definition of science has been influenced by the increasing relationship between industry and the school. Consider the following statements:

From a BRT parent:

> *We do not have a science background in this community because industry is not here.*

From a PINE CITY employer (p 6:47):

> *The right attitude to work is what we need, not specific training for the job. If industry gets people with the right attitude, we can teach people what they need to know, probably better than the schools, because we can teach them on the job.*

From a science coordinator at our urban trial site:

> *In February, March and April, people in the truck farming areas and the horticulture industry and so on are asking for young people to help them out onto the market. There always has been a demand, and we will be able to fill that demand with that speciality in agri-business during the demand period.*

The increase in vocation fields open to women was reflected in increased enrollments of women in math and the physical and biological sciences (see Chapter 15). One female student from PINE CITY said:

> *I know a lot of girls who are thinking of taking engineering in college. More of them are thinking about majoring in aero-space engineering. They're thinking more along that line of work now . . . than they have in the past.*

In places where the feminist movement has not been strong, we noted a low enrollment of girls in science courses. The FALL RIVER physics teacher gave the following explanation of the 1 to 9 distribution in his class:

> *A lot of times girls do well in mathematics; this isn't what holds them up. They simply don't see physics in their career plans. They don't see it as a prerequisite to anything they plan to do.*

The vocational emphasis on schooling was forcing parents, counselors and students to predict where the jobs were going to be so the student could jump into the courses that would have the highest payoff. One student who participated in the PINE CITY site visit explained:

> *There's a greater demand for medical technicians now, but the trend could change in a few years. It changes all the time. [The students] go from one area of study to the next, wherever the greatest demand is.*

Prediction of employment possibilities demands information, and a pipeline has developed between high school students and their older peers, as we learned in FALL RIVER:

> *The younger kids pay attention when the college grad speaks. He goes out and can't get a job--they pay attention. Maybe they'll go to college, maybe they won't. He's disappointed with science--it really makes a total difference.*

This results in a rapid feedback to the schools of what the job market is. It appeared to exert some long-range pressure on course scheduling as students enrolled in those courses which appeared to enhance their employment goals.

Many people (but not all) felt the school should be even better tuned to the job market. From RIVER ACRES we heard:

> *We don't spend enough time on career education. This is something that ought to be integrated into the subject matter. It's amazing how many people are graduating who really don't understand some of the jobs that are available.*

The counseling provided by the school was often seen as inadequate by students who planned to enter the job market. College-bound students sometimes voiced the same complaint. From URBANVILLE, we heard that advice on college admissions is sometimes not available:

> *Most of us, as far as college plans are concerned, would really like to have a chance to sit down and talk with a counselor, but the counselors aren't there and there are too many kids.*

Often this failure to obtain counseling extended to course selection:

> *I think the opportunity is here for us to prepare ourselves for college, but some of the kids don't take advantage of it and some of us don't know what we're supposed to be taking advantage of. We're not sure of what we should be taking and what we should be leaving out.*

A number of teachers also felt that the counselors were providing no help in getting students in the right science course (see the comments of a FALL RIVER physics teacher, p 2:17). Even worse, in URBANVILLE occasionally a counselor was seen as steering a student away from science to easier courses in order to preserve his or her grade point average. We asked about this questionable advice in our national survey and were told that it is very rare for high school counselors to encourage students not to take science courses.

In RIVER ACRES one of the counselors' primary responsibilities was placing the students in tracks. While there was general agreement about who should go in the highest and lowest levels, there was a great deal of questioning about level two. There was essentially no empirical data on this group's performance (see p 1:72). A principal source of conflict in RIVER ACRES was the tendency of counselors to place students in a track without consultation with teachers or without regard for their recommendations (see pp 1:94, 1:100 and 1:195). There also was conflict between counselors and parents there over tracking and grading. Often a student would get a "C" in an accelerated course when he or she could have gotten an "A" in a level 2 course for the same performance. But overall, there was little doubt that the counselors were trying to do what was best--as they saw it--for the child.

Occasionally we heard about counselors routing students into the sciences, as in the following case (p 6:66):

> The business of counseling was number one or number two among the gripes of the physics teachers. On the other hand, at least one student from PINE CITY reported that her counselor had encouraged her to stick with chemistry when she wanted to give it up, a decision she subsequently felt was a good one.

As with teachers, we found some counselors strong and some weak. Most had heavy loads and were expected to deal more with in-school decisions and problems than with long range planning.

VALUES

Directly and indirectly, the science student is introduced to different role-models. He or she is encouraged to be more like the scientist, or the science teacher, or the ideal science student, who may from time to time appear quite different. On one occasion the ideal may be:

observing,
skeptical,
relativistic,
speculative, and
searching for the flaw in all previous thinking.

On another occasion the ideal may be:

precise,
objective,
analytic,
impersonal, and
searching for the definitive experiment.

And on still another occasion the ideal may be:

careful,
conforming,
anticipatory,
productive, and
searching for the answer to the problem.

Of course these are not pure types and the values taught young science students may come in any number of combinations. But one can recognize in various writings and teachings such archetypes as the grand thinker, the technical virtuoso, and the trustworthy subordinate. Students were beckoned by such ideals in many of their science classes.

It used to be more common to hear claims that science is value-free.* In our studies of eleven clusters of public schools we heard very few science teachers making such claims, though it was common to hear words from which it was easily inferred that the control of bias, the pursuit of value-free knowledge, and solution to value-laden problems could be facilitated by taking a scientific approach to the matter. No end has come to the teaching of the values of science as a contribution to thinking, problem-solving, and preparing for the tasks of life. But it was a relatively quiet evangelism in the CSSE schools.

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*For the counterclaim see Jacob Bronowsky, Science and Human Values (New York: Messner, 1956); and André Cournand, "The Code of the Scientist and its Relation to Ethics," Science, 18 November 1977, pp. 699-705.

It is clearly recognized today that many public controversies involve scientific topics. To name a few, there is the control of population growth, the teaching of evolution, debates over when the human embryo becomes a living person, the control of recombinant DNA research, the danger of nuclear power plants, and the diminishing ozone layer. Students recognized these as science topics. They were not able to, as the greatest mind is not able to, see the "bit of pure knowledge" as separate from that same knowledge in a social context. Students have learned that it is okay to snicker when anyone--and certainly a teacher--claims that science is value-free.

Rather it was commonly accepted that science has its values, and its involvement in controversial topics, and its lobbies in the houses of government. We did not find it to be a common topic of conversation. It was not that it had not been studied. It was just that the age of innocence had passed.* Youngsters and teachers alike knew that scientists were human and science was political--but of course they admired some ways of behaving more than others, and many of the good ways they continued to associate with science and scholarship.

The qualities of the grand thinker, relativistic and speculative, were only occasionally acknowledged by teachers to be worth emulating, and often--removed from association with science or grand thinking--were ridiculed. The qualities of the laboratory technician, precise and analytic, were more frequently acknowledged by teachers to be what it takes to succeed in a scientific or professional career. But the qualities of the trustworthy subordinate, careful and productive, were urged upon students almost without interruption.

One would expect more opportunity in the social studies than in the natural sciences, and certainly more than in mathematics, to consider value-laden and controversial subject matter. But even in the social studies we did not find serious controversy over teacher presentations within the communities we visited. The handling of "taboo" topics was not one of the issues that concerned people we talked with. However, it became increasingly clear that teachers were strong advocates of "American values" in all three subject matter areas.

This effort to inculcate a set of values will be reported later in this chapter and again at length in Chapter 16. Though the data were seldom direct or systematically probed, this finding was later felt to be one of the most consistent of the CSSE case studies project.

As indicated four paragraphs back, the value-free claims of science were transformed partly into value-control claims, claims that the bias of ordinary perception can be controlled by reliance on scientific methods and science-tested knowledge. The control of bias would be mentioned when answering the question of why science is studied. That is not to suggest that it was often mentioned, but the reference was made. And it was most frequently encountered in the CSSE classrooms when the class was scheduled to deal with, or more frequently, stumbled upon, a controversial topic.

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*As had passed the shock that some of science's peacetime products were as potentially great a threat as its machines of war.

Controversial Topics. Most teachers were quite sensitive to, even if they did not personally hold, the dominant values of the community. They seemed, by and large, to find no problem in presenting their subject matter in ways that were acceptable to most local feelings.

There were at most two or three allusions to controversy over the treatment of controversial topics in the eleven case studies. Teachers interviewed seemed confident that they knew how to handle such subjects to avoid difficulty. For example, there were no "creationist" protests against the teaching of evolution in any of these schools. The biology teacher at BRT, a school in a conservative community, described her approach this way (p 4:11):

> *Evolution has never come up as an issue. I don't know. My personal view is probably close to safe because I don't see any divergence between the theory of evolution and a religious viewpoint. I suppose I'm not really radical. Maybe that's the reason I haven't had any feedback. If I were an atheist, I suppose that might present a problem. And the students don't make it a problematic discussion either. Never had anyone do that. Here again, our students are pretty much of one mind. They're pretty closed in the ideas they have. I've hardly had any feedback from the community.*

The same teacher went on to say:

> *Some places have had controversies over sex education. We teach it in health, and in biology when I go over the reproductive system I discuss contraception and venereal disease. We feel it's necessary for kids to know these things. We give it simply on an information basis. Most of the parents prefer that the kids get it here because a lot of them don't know much of this stuff. As long as you don't get into the moral aspect.*

In a district where there was no "approved reference book" on human sexuality (perhaps an influence of the predominantly Roman Catholic population) at least one teacher had spent his own money to buy such books for his class and had taught the subject to his students.

After observing in RIVER ACRES Terry Denny wrote (p 1:53):

> The only junior high school social studies teacher in the district that I saw approaching what could be called a controversial topic had this to say after class:
>
> > *The teaching of man's relation to himself and others necessarily brings up religious, political, sexual, ethnic, racial problems and deals with very touchy subjects because of what shall we say, the Bible Belt?. . . If you mention certain things to certain students it goes home and the school board gets calls about it . . . this is not what the community wants so we don't do it.*

One teacher told our URBANVILLE site visitor team:

> *The people who tend to get in trouble using something that's new and different, many times just ask for it by being inflamatory themselves. We always look at these issues in a perspective, with their counterparts, their opposites. We don't say, "Let's have a course on communism, per se." We compare communism with other ideologies.*

and another teacher from URBANVILLE said:

> *Most teachers are very careful about the way in which ideas are presented. That is, they're not afraid of presenting ideas, they just do it in a very professional way. You head off a lot of problems simply by doing that.*

A PINE CITY teacher raised the issue of eugenics and population change through differential birth rates. He was certain that teaching such subject matter would cause problems, and it was clear that he was not suggesting an unbiased presentation either. He wished to attack the subject on a problem-solving basis:

> *I think in the field of education that we're failing miserably when we do not attack our reproductive problem. If you want to, call it "sex education." I don't care what you call it. We presently are probably at a stable population growth throughout the U.S. . . . I believe that we need a thorough course in biology . . . that we need to attack our sex education in a proper, forthright manner . . . (But) if you forthrightly, openly attacked the reproductive problem, issues, etc. and advocated certain types of birth control, then there is that certain amount of puritan spirit that would attack you.*

Advocating a position on a controversial issue was one thing most teachers did not do. Otherwise, almost any topic was fair game for discussion. One teacher said that you could teach anything because, "As long as the kids are quiet and well-satisfied, nobody is really going to care what they're being taught."

We were a little surprised at teacher willingness to discuss subjects which had stirred public reaction in some places. We sometimes thought the school people were overly set on maintaining that there were no constraints on what they may teach. But we were eventually persuaded that most discussed topics they felt a responsibility to teach--and those few topics they felt constrained not to discuss were topics they considered almost always outside their responsibility and desire to teach. So we found essentially no "academic freedom" or "censorship" problems.

We still thought perhaps there may be new taboos which have not been recognized as such. Teachers may have failed to identify them because no one has challenged their absence from the classroom. One possible candidate was cancer, for which there are a number of euphemisms, including "C.A.," and "malignancy," a good indication of heavy social injunctions against its discussion. Death is also a subject that may be considered a potential taboo. In both cases, there have been efforts on the part of both national leaders and sociologists to bring these topics out into the open, another good indication that a topic is banned. Miscegenation is probably another. It is difficult to imagine a teacher in a southern classroom (or northern, for that matter) feeling free to discuss this subject, even objectively. All this would suggest that if there were taboos, we did not ask the question in the right way to elicit them. If there are new emerging taboos, many adults may be unaware of their existence.

When we asked about controversial subjects in our national survey, almost 1/3 of the parents of seniors felt that federal funds should not be spent on curriculum development in these areas. Almost 60% of the teachers polled supported such development, and 46% of our senior respondents did also.

> Some parents believe that certain topics should be left out of science and social studies courses, topics such as evolution of the species, human reproduction, and family attitudes and customs. Some parents want such things taught, and of course, want them taught well. . . . We need to find out how they feel about using Federal Funds for development of teaching materials that include such controversial topics.

7-9 Soc. Stud. Teachers		10-12 Soc. Stud. Teachers		High School Seniors		Parents of Seniors		
N	%	N	%	N	%	N	%	
5	13%	3	9%	18	21%	35	33%	Federal funds should never be spent on such development
4	7%	7	10%	98	22%	27	12%	It is all right to spend federal funds this way if it will not cause trouble.
25	58%	20	59%	196	46%	63	29%	It is important to provide federal support for such development.
8	21%	10	22%	42	11%	22	27%	Other
41		40		354		147		

(Percents reported in this chapter are based on those responding and weighted by states according to the RTI sampling plan. See Chapter 18 for Standard errors.)

It is clear from these results that science and social studies teachers were not without substantial community support for their advocacy of developing better programs in controversial areas. Parents did tend on the whole to be more conservative than teachers about the expenditure of public funds in these areas.

Traditional American Values. When we looked for advocacy of traditional American values in the classroom, we seldom found science teachers explicitly advocating such values--with the exception of conservation of natural resources. While this topic is certain to stir controversy in many communities where industry and environmentalists clash, teachers in our sites seemed to encounter no noticeable opposition to the very strong positions some of them took. Perhaps conservation education has been a part of school curricula for a long time--since the "dust bowl" of the 1930's, and it is easy now for energy conservation to be added to soil and water conservation. An official of the City of Houston, a strong advocate of energy conservation, mused that school buildings tend to be energy wasteful, while teachers make conservation presentations in class.

Conservation, as a basic American value to be taught to youth, though not always practiced in the competition for personal wealth, may be closely associated with the "work ethic," productivity of the individual. This is reflected in often quoted sayings. "Waste not, want not," and "A penny saved is a penny earned." Teachers were aware that they were preaching ethical values in this area, but usually felt so strongly about these values that they did not worry much about being indoctrinators. A PINE CITY teacher, who told site visitors enthusiastically about plans to have her students pick up highway litter and measure it, ended by saying:

> *Maybe I'm pushing too much of my own values onto my students because this ecology is a big thing to me, this pollution.*

The Homogeneity of the Community. The level of overt training in values appeared to be strongly related to the homogeneity of the school community and the teacher's integration into the community. Furthermore, specific values, above and beyond those relating to academic preparation and the work ethic, may be developed depending on the cultural background of the school. At BRT, a highly homogeneous site (not one Jewish child in the school, only one black student) and a traditionalist one (people talk about "training future citizens"), one coach-principal talked to site visitors about the role of the social studies teacher in terms of changing the child's value system and affecting the community at large.

> *If a lot of new people came in here, if they were not white Anglo-Saxon protestants or catholics, we'd have trouble, without question. There are a lot of people here whose prejudice isn't that far below the surface. This is a place where a person who teaches the social studies has an obligation to try to open people's minds up a little bit on things such as this. . . . The school is crying for more students but if we have a lot of new people come in, especially different racial and religious groups, they'd have a lot of problems. The whole community would have a lot of problems.*

Observer Jacquetta Hill-Burnett also spelled out the greater freedom that results from having only one ethnic group (black) in the ARCHIPOLIS schools she visited (p 9:24):

> There is a distinct message to all students that getting it together and doing well is not just a matter of individual choice and circumstance, but inevitably has implications for the ethnic group. This sense probably could not have been emphasized to such a degree in a more ethnically heterogeneous student or teacher population. . . .

However, even in a highly homogeneous community such as ALTE, certain values were not discussed. During one site visit, the teacher's question, "What was the dominant attitude of Americans toward the rest of the world at the end of World War II?" drew from one of the students the answer, "That people didn't love each other enough." This was greeted by snickers from his classmates. The teacher elaborated on this briefly, and later confided to the visitor that he certainly wished he could have supported the student more strongly. (The entire incident warrants further reading; see p 16:11.) Both the reactions of the children in the class and the teacher suggested that this one value--agape love--was not comfortably discussed in the classroom.

In more heterogeneous districts, such as URBANVILLE, GREATER BOSTON, FALL RIVER, and WESTERN CITY, there was some reason to believe that the heterogenity itself and the resulting conflict of values limit teachers' freedom to express their values. Someone who has taught in both heterogeneous and homogeneous communities may have noticed what Mrs. N, in BRT described, that student-teacher interactions were far less intimate in a metropolitan school than in the rural school. She liked the fact that she knew much more about her students (e.g., how they felt about things) in BRT than she had known in the large city school, mainly because at BRT they dropped around after school to talk. She knew their parents and older siblings who had gone through that same school before them (observer Allan Peshkin's field notes).

It is fairly clear why a higher level of constraint on the teacher, as far as the expression of individual values, may emerge in schools with a highly diverse population: the teacher's values conflict with those of at least some of the students. Resonating to common personal values makes teaching worthwhile. The teachers remembered best are ones who included students as humans worth caring about, more than ones who were outstanding in physics, mathematics, or social science. A high school senior described such a teacher:

> *He really cared about his students. . . . His way of teaching--he was getting old and wasn't really organized and direct--but I still think he taught a lot, not necessarily about agriculture but about human morals, human life, how to be a good human.*

But it is more difficult to care about those whose cultural values are strange.

One ALTE teacher told site visitors that if the high school social studies department to which she belonged were to become involved in an inter-departmental effort to improve student reading and writing, about which teachers and parents were complaining, "the teachers would lose their academic freedom." It appeared more sensible to her to have someone else do it and keep ill-prepared students out of "good" classes. Teacher pride and prestige in their discipline were often communicated to students as values. One result of heterogeneity was that teachers felt less influential in the guidance of children. As pressures constraining the teaching of values directly were reduced, the teacher's perception of his/her function seemed to diminish toward one of relaying facts. At any rate, we often found that physics and chemistry were perceived as cut-and-dried collections of facts that could be adequately treated by simply relating them, without emotional connotations, without enthusiasm, without excitement, without creative insight.

Biology usually involved more emotional experiences. For example, there were animals in the animal cage: some were loved, some were feared, some were killed, some were born. Students expressed their own values about these experiences.

If the school's role in the transmission of ethical values is diminishing we suspect that the more nurturing teachers will find teaching more and more onerous. A teacher who conceives school as a communication system relaying facts may survive in a heterogeneous, highly political school system better than one who sees it as a social system developing values. For good or ill, most teachers in our sites continued to find a way to become involved emotionally and to teach values--although they often were not ones idealized by science education specialists. (See pp 16:7 through 16:11 and chap. 16 passim.)

Ritual and Mathematics. In the public schools, overt religious and ethical instruction has been diminished through national decisions and changed perceptions about what is properly discussed there. The enforcement of integration law and a growing recognition of our pluralism, and the accompanying decline of the melting pot ideology, has left many teachers confused as to what formal and informal codes the schools should enforce. Still, we found a high level of covert moral instruction. It was accomplished partly through ritual, some of which is unique to the school (e.g., testing, reporting attendance, asking permission to leave the room) and some of which is common to the culture (e.g., saying please and thank you, waiting your turn in cafeteria lines).

We considered an act ritualistic if certain aspects of its performance had no direct relationship to the recognized or stated goal of the activity. In many cases involving school conduct, the line between what is patently functional and what is perceived as merely ritualistic was not easy to draw. It in fact shifted depending on the circumstances and the participants involved. For example, maintaining a certain level of order in the classroom was apparently necessary for teaching and learning to occur, but maintaining the level of order that had traditionally been maintained (having a student ask for permission to sharpen a pencil) was probably ritualistic. Requiring that a child ask permission to go to the bathroom or to approach the teacher was probably functional for the teacher but ritualistic for the child.

We were told that patriotic and religious rituals were being reduced--although prayers were still maintained in two southern-site schools. Dress codes were not obvious. Standing when visitors or the principal entered the classroom appeared to be a disappearing custom. One teacher in GREATER BOSTON confided to a site visitor that the teachers were too lax about student comportment--but because the teacher wishes were in opposition to student wishes, teachers could no longer exert strict control and survive. Obeying rules of courtesy (standing when an older person enters) is not only a sign of respect; it is tone to teach respect. The youngster's perception of the older changes as he stands, perhaps as the Thai's perception of his king changed as he kissed the ground at his feet. A teacher's recognition of ritual was put this way at our rural trial site:

> *I still think America came farther and faster than any nation in history under the old method of teaching, where we had some discipline in the classroom, we did some drill because it was what*

> *teachers deemed was necessary, we didn't have to try to justify all that we did.*

Anthropologists have maintained that a certain level of ritual is necessary for social systems and cultures. If many traditional rituals are disappearing (perhaps in response to the same pluralism that seems to be attenuating the explicit teaching of values), other rituals may be adopted by teachers to provide the same underlying function of moral training and control. However, the level of school ritual that students will tolerate will, to some extent, be influenced by their perception of what constitutes an educated person. When classic education was standard, it was necessary to participate in the ritual learning of "dead" languages--whose value for speaking, reading, or writing was almost nil. If an education is seen as most successful when it results in highly lucrative employment, then the rituals that will be sustained will be ones that are performed by the rich. Cynicism will probably continue to devalue most recognized rituals but the number of rituals will not necessarily decline. Tangible rewards such as the ability to manipulate environments or people may now be replacing the intangible rewards for completing the ritual.

Good candidates for a ritual to fill "the vacuum" are subjects whose functions have recently been severely curtailed in terms of real utility and whose teaching has been highly structured. Arithmetic is apparently such a subject. First, with the almost universal distribution of pocket calculators, there is much less purpose in computational drill. We also heard from a number of people, including an engineer-parent quoted here, that even advanced high school mathematics had little practical value. He said:

> *I never used algebra or trigonometry or solid geometry when I got out of school but that's what they taught in junior and senior math, and I've often wondered, "why?" Where would the average person ever run into the need for that type of math?*

However, both teachers and parents see the performance of certain arithmetic skill as having a socializing value. One teacher claimed that the student who did not succeed in this area would not succeed as a citizen:

> *This particular student in individualized instruction is working toward the right answer only and really has no understanding of the problem, whether it's mathematics or science, and this student will probably be the individual that someday will be out in society not really understanding what he's doing in his home or any other facet of the environment.*

When the subject of hand calculators was raised with the group of URBANVILLE parents, the level of emotional response suggested that the topic was not one of utility but of ritual, which typically has a higher affective component. They said:

> *I think using hand calculators is an awful shame because that's why our brains are going so lazy.*
>
> *Calculators should be forbidden in math classes, at any level, because even in higher algebra and trig processes, the learning process is by doing it.*

> *Kids are lazy, people are lazy, I'm lazy - and you're going to get by with as little as you can. . . . I think they should be required to take a little more. The program is getting watered down.*

It perhaps is significant that elementary school teachers resisted any diminution of instruction in arithmetic, even though many of them showed a high level of anxiety about it. Is a component of this anxiety the fear of failing in the performance of a ritual?

School people and the public were making a strong defense for preserving traditional subjects having ritualistic force. Some seemed to be used in imbuing moral attitudes related to work ethic: responsibility, diligence, persistence, thoroughness, neatness. Instilling such disciplinary traits was sometimes a more primary function of the school it seemed than disseminating information. As we were reminded by Preston Ward, the manager of a manufacturing company in PINE CITY (see p6:48 for full quote):

> *I don't want to be seen as criticizing the co-op program because I think they do a really good job. But what is most important about the program is the attitude that the students learn towards work rather than the job training they get.*

It seemed that the teacher may overtly teach those moral values and demand compliance with rituals which relate to the work ethic without loss of community support. Their association with science is not recognized in the language and theory of education or in the official goals of the school. In other cases, such as the taboo areas reviewed above, the school was no longer seen as the appropriate arena for moral instruction and guidance, only for the dispensing of information.

What are the implications of these perceptions of mathematics (and some aspects of natural and social science) particularly for NSF? It seems that inventing more successful materials and methods in mathematics/arithmetic will be a more difficult and complex task than has been imagined heretofore, because it is one of those remaining areas which have a ritualistic function in school.

The Teaching of Values and the Social Sciences. Social scientists explicitly study human value systems, and social studies teachers have traditionally aimed to inculcate the American way of life. Yet as we talked to social studies teachers it seemed to us that they were more diverse (than science or math teachers) in their expressions of values in their classes. The diversity of perspectives in the social sciences may cause the diverse approaches to social and personal values we found in the social studies teachers.

In our national survey we included several items regarding the teaching of values and the control of bias. In one situation we asked 150 social studies teachers, about 300 senior students and their parents (one parent for each) about the emphasis on personal values in high school social studies courses. We found that most respondents did not indicate a need for change in emphasis but of those who did the preponderance of respondents asked for more emphasis rather than less. More than one of three parents and students indicated a preference for greater emphasis on teaching about personal values.

The question went like this:

> As you look at social studies courses in your high school and elsewhere, you probably see things that concern you. Please check those things below that you consider major problems. (Check as many as you wish.)

7-9 Soc. studies teachers		10-12 Soc. studies teachers		seniors		parents of seniors		
N	%	N	%	N	%	N	%	
18	36%	13	27%	168	40%	32	14%	Too much emphasis on facts, not enough on concepts.
8	16%	11	26%	47	13%	33	39%	Too much emphasis on concepts, not enough on facts.
4	8%	2	4%	43	8%	14	5%	Too much emphasis on teaching about personal values.
12	24%	13	27%	122	35%	49	36%	Not enough emphasis on teaching about personal values.
7	16%	5	21%	75	23%	48	47%	Not enough qualified teachers.
9	17%	10	16%	104	17%	22	16%	Belief that teachers teaching the same course should teach the same things
42		41		307		146		

The other responses will be discussed in Chapters 13 and 14

In the survey questionnaire, we presented the scenario below to stimulate thinking about the matter of freedom of teachers, and students, to express the biases they have. It was presented to social studies teachers in both junior and senior high schools, high school seniors, and parents of seniors.

12:37

Scenario Y

At Metro High School, Mr. Robinson's American History class is studying immigration and the settlement of America, noting particularly how immigrants have influenced the growth of their city. Here is a dialogue midway through Monday's class:

Mr. Robinson: After the Irish immigration of the 1840's and after the importation of Chinese laborers, what other waves of immigration occurred? Sally?

Sally: Europeans around 1890 and then again after World War I.

Mr. Robinson: Good. I guess that's when we got our Polish jokes, right? (no one laughs) Well, let's see. What sort of long-time trend are we studying?

Sally: People coming to America.

Mr. Robinson: Why did they come, Tammie?

Tammie: To come to a country with freedom.

Doug: (sarcastically) Like freedom to pick cotton.

Mr. Robinson: Well, let's think about that. Some of the early colonists were seeking freedom. Were the Chinese who came after the Civil War seeking freedom? (no answer) What were they looking for? (no answer) What were the Irish looking for?

Wendy: Food !

Mr. Robinson: Food more than freedom? Let's make a list of possible reasons, then consider each one.

Eric: My dad says we should be studying how to send them back where they came from rather than how they got here.

Mr. Robinson: Okay, that's an idea. After we make our list of reasons for immigration, let's figure out who wanted the immigrants here and who didn't want them. And then let's decide whether I should be sent back to Africa or Europe.

12:38

Scenario Y

Mr. Robinson is asking questions about history and joking about it. What is your reaction to his teaching style?

7-9 Soc. Studies Teachers		10-12 Soc. Studies Teachers		Seniors		Parents of Seniors		
N	%	N	%	N	%	N	%	
27	51%	22	54%	186	61%	87	41%	It is fine for some teachers to teach this way. It gets their attention.
3	22%	3	16%	26	9%	20	19%	I find it offensive.
5	16%	7	12%	70	18%	27	28%	I don't mind, but he is not likely to to get the job done.
7	12%	1	2%	71	11%	11	12%	Fine in principle, but . . .
42		41		370		146		(Total Responding)

Do teachers and students talk like this in your school(s)?

7-9 Soc. Studies Teachers		10-12 Soc. Studies Teachers		Seniors		Parents of Seniors		
N	%	N	%	N	%	N	%	
8	11%	9	31%	55	14%	34	21%	Yes, lots do.
26	55%	24	46%	261	56%	83	32%	Yes, a few do.
6	28%	7	22%	44	30%	14	43%	No.
2	6%	1	1%	1	-	10	3%	Other.

Scenario Y 12:39

How common is it for teachers in your school(s) to try to teach the scientific analysis of social problems?

7-9 Soc. Studies Teachers		10-12 Soc. Studies Teachers		Seniors		Parents of Seniors		
N	%	N	%	N	%	N	%	
3	5%	7	20%	48	8%	11	2%	Quite common
7	17%	7	18%	81	23%	21	25%	Sometimes
9	20%	3	10%	25	15%	5	2%	Never
5	13%	-	-	6	1%	26	10%	Don't know
-	-	-	-	-	-	-	-	Not school's job
1	3%	2	3%	53	10%	5	2%	Some teachers do
-	-	-	-	-	-	-	-	What is it?
-	-	-	-	1	5%	-	-	Communist
13	20%	14	27%	62	15%	21	16%	Other
4	23%	8	22%	85	24%	59	43%	No Comment

Perhaps the most impressive finding from the questions relating to this scenario was high proportion (more than 70% in three groups, and nearly 60% in the fourth) of seniors, parents of seniors, and junior high and senior high school teachers who felt that teachers should express their own feelings, but present alternative views too. The fact that 24% of the parents of seniors felt that teachers should keep their biases to themselves could be a critical factor, however, since only one or two concerned parents can upset school operations by pleading to the school board, or ultimately to the Supreme Court. The question presented and the responses were as follows:

> Mr. Robinson seems reluctant to accept the idea that most immigrants come to America seeking freedom. Let us suppose this is a bias of his. How important is it for social studies teachers to keep their biases to themselves?

7-9 Soc. Studies Teachers		10-12 Soc. Studies Teachers		Seniors		Parents of Seniors		
N	%	N	%	N	%	N	%	
9	15%	5	16%	44	11%	40	24%	They should recognize their biases and keep them to themselves.
1	2%	1	2%	31	7%	6	1%	They should speak honestly as to how they feel on matters.
26	72%	25	59%	254	78%	94	72%	They should tell how they feel but present alternative views too.
6	11%	10	23%	30	4%	6	3%	Other
42		41		359		146		(Total Responding)

In response to an even more specific question on this topic, a surprisingly high percentage of our respondents seemed to be supporting the teacher's expression of his/her social judgments in the classroom, provided he/she indicated his value-orientation. As in the preceding question, approximately one-quarter of the parents of seniors polled indicated it was wrong for the teacher to do this, a fact which probably explains the low frequency of this sort of teaching. The question was:

> Suppose Mr. Robinson was leading up to a critical analysis of the free enterprise system. Suppose he intended to say that the system was dishonest, that it was cruel in the way it imported cheap labor from foreign lands to work in this country. Do you feel that it would be inappropriate for Mr. Robinson to acquaint the students with his conclusions about the free enterprise system in early America?

7-9 Soc. Studies Teachers		10-12 Soc. Studies Teachers		Seniors		Parents of Seniors		
N	%	N	%	N	%	N	%	
6	9%	1	1%	55	15%	32	11%	It would be right, in fact it is his responsibility to be frank.
24	61%	30	75%	165	41%	72	46%	It would be all right as long as he indicated his value-orientation.
3	6%	0	0	16	8%	6	14%	It is ethically proper, but it would be foolish to do so.
6	16%	3	5%	65	19%	28	23%	It is wrong for him to use his position for teaching those things.
3	8%	7	20%	53	17%	9	5%	Other (please explain)
42		41		354		147		(Total Responding)

The scientific code of indicating one's bias has the strongest support, but 9% of the junior high school teachers chose frankness without such an indication of bias.

SCIENCE FOR THE CITIZEN

Some science for every citizen is found in our case study sites. In science education, efforts to make science relevant to the concerns of all--not just the college bound nor the exceptionally talented student nor those anxiously looking for a job--were found. To make the study of science attractive, popular, and useful is important. To involve all students in some exposure to science is one of the aims of science education as we have found it in our studies.

Science as General Education. Each of the sites had a commitment to science in general education. Each had a general education course of study that included some work in the sciences. General education courses of study, in most instances, referred to the courses of study taken by students not in either a college preparatory or vocational track. Often students in those tracks were also expected to complete "general education requirements."

The idea of general education probably developed out of the liberal arts tradition. Many would agree with the following statement by Broudy* as a good definition of the purposes of general education:

> *The special domain of the school has been knowledge, truth as certified by those expert in its discovery, defense, preservation, and promulgation. The autonomy of schools needs no other or more ultimate legitimation. This is the knowledge that can make men free. . . . In general education, the school would induct every pupil into the vestibules of connoisseurship in all phases of human life. It would preach openly that not only is the unexamined life not worth living, but that the cultivation of one's power for living well is a duty as well as a high privilege.*

This seems to be a desirable goal statement for general education. However, the implementation process has resulted in an operational definition that is much more utilitarian in nature. General education courses of study were oriented more towards the idea of "minimal competences" or "functional literacy" than toward induction into "vestibules of connoisseurship." General education is as preparatory as is college prep and vocational education. The field observer at RIVER ACRES did not differentiate among courses of study when he observed that (p 1:12):

> teachers see their. . . teaching as getting youngsters ready. Preparation for the next grade; . . . for the more difficult courses to come; . . . for life.

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*Harry S. Broudy, The Real World of the Public Schools (New York: Harcourt, Brace, Jovanovich, Inc., 1972), p. 230.

Students were considered to be prepared (at least minimally) when they have acquired knowledge, competence, and skill in certain areas of content. They have been prepared for the world in the sense of being able to make the appropriate response. They were perhaps less so prepared in the sense of understanding the world and themselves.

A general education course of study was usually much more flexible in terms of requirements than college prep or vocational education. The requirements in general education essentially defined the minimum referred to in the previous paragraph. The electives, of which there were usually many, constituted a sort of potpourri of things that are nice to know. The selection of electives may come in handy someday or may be of sufficient interest to keep one in school. The pattern of electives did not seem to have a coherence that would contribute to the students' attaining the kind of general education that Broudy espouses.

This circumstance was probably due to several factors. One factor which certainly had much impact on general education was the majority of students in the general education course of study who were characterized as "less able and/or willing." Teachers would surely like to help them see the broad picture. But the frustrations in trying to do so are exemplified by a comment of a teacher in PINE CITY (p 6:18).

> *In general science classes we have general to basic students. I think the only way to reach them is to teach them something they can relate to, i.e., no abstractions. I have left the book almost entirely in order to teach things they can relate to and enjoy and I find I get more response and motivation in this way. (emphasis added)*

General education requirements in the sciences were remarkably similar across the sites. In mathematics, the requirement was usually two years of mathematics beyond the elementary grades. This requirement could be met with courses that were essentially repetition of elementary school arithmetic although most general education students take one year of algebra. There seemed to be little attempt made to stimulate the interest of general education students in mathematics beyond the minimal requirement.

The social studies requirement typically involved four years beyond elementary grades. Course titles were: World History, American History, Government/Civics, and perhaps some geography. Study of state history was required at most sites. Most of the sites offered a variety of electives in social studies in an attempt to stimulate additional study in this area. Psychology, sociology, and economics were course titles found at most sites. Anthropology, History of Latin America, and philosophy were examples of less commonly found courses that probably reflected an interest or concern of a teacher or particular community.

The general education requirements in science were typically two or three years of study beyond elementary school. The course titles were general science, physical science, earth science, and life science or biology. Tenth grade biology seemed to be as much a part of the American scene as apple pie. The science experience of general education students usually culminated with biology. Physics and chemistry were taken almost exclusively by college prep students only.

General education a la Broudy has long been a goal of American schools and most schools have some sort of general education course of study. It has been apparent, however, that the course of study as we saw it has not achieved the goal. Different attempts have been made to arrange curricula courses to enhance general education (e.g., core curriculum, interdisciplinary studies). There were signs that environmental education was providing for the effective integration of subject matter that stimulates the students to "examine the life worth living." A FALL RIVER teacher defended his course as follows (p 2:6):

> *The person just can't be an effective citizen unless he can read and understand political issues that have scientific overtones . . . The average citizen has to have the awareness and appreciation of how his actions affect the environment and what is likely to happen depending on the choices he makes now.*

While the quote suggests a "preparation" purpose, it also reflects a recognition that examination of one's life and the world requires integration.

Popular Science. Many of the sites tried to stimulate general education students as well as students in other tracks to study science beyond the requirements. They do so with an attractive elective program. (See ALTE, FALL RIVER, RIVER ACRES, URBANVILLE, WESTERN CITY.) The electives have titles that reflect an attempt to "popularize science" or to provide students with a base for dealing with issues that are science related and of interest to all citizens, e.g., environment and ecology. Examples of elective course titles were oceanography, marine biology, plants, mechanics, genetics, electronics, space science, environmental studies, and ecological studies.

Around the country, we found a spate of new course offerings and programs that appeared to be attempts to make science relevant to the "here and now " pop scene. These include URBANVILLE's horticulture program (p 5:5) and wildflower/edibles course (p 5:4). FALL RIVER's TREK program was structured around knowledge of the galaxy and includes such high interest topics as black holes and UFO's (p 2:15), and the community study projects conducted in VORTEX (p 10:10) and ALTE (p 3:49). There were also outdoor education experiences which were very popular with both students and teachers. (See Chapter 13, Out of School Learning.) These included FALL RIVER's Eco-Week (p 2:22) and ARCHIPOLIS' Field Science Camp at Mt. Airy (p 9:17).

From WESTERN CITY site visitor Charles Weller reported:

> The school I visited was 30-50 years old and was anything but elaborate. It had a contained courtyard approximately 150 feet by 150 feet. There were no [scheduled times for] the science curriculum, there were teachers identified as science teachers. The principal was an ex-science teacher and a believer in a do-it-yourself philosophy of teaching--students, teachers, et al.

The courtyard provided the primary focus for a variety of dynamic science activities and projects, though the extent of them was by no means limited to the courtyard nor to science. Some of the different projects in the courtyard were:

Running Water Pond with Waterfall
Greenhouse for Plants and Seedlings
Individual Vegetable Garden Plots
Concrete Walled Snake Pit
Two Aviaries with Tortoises
Lapidary with Cutting, Grinding, Polishing Wheels
Mosaic
Mountain (under construction)

The noteworthy aspect of this whole undertaking is that all of the work was done by students under the supervision of teachers. Most of the materials were scrounged. Only the wood, screen and cement needed to construct the various projects were purchased by the school. Vandalism was practically nonexistent despite the fact that students had free access to the courtyard during lunch and other times. The reason given was that they felt it was theirs. (The one exception was that radishes seemed to disappear as soon as they got to be eating size.)

From a number of quarters we have heard about the impact of television on the interests of students. Interest in such programs as "Wild Kingdom" and the Jacques Cousteau series were mentioned (PINE CITY, p 30). In an effort to respond to popular interests, teachers occasionally integrated what they were teaching in the classroom with TV programs. (In one of our site visits, a teacher described his social studies unit on Africa which concluded with the series, "Roots.")

Some attempts to popularize science with elective courses seemed to be experiencing difficulty as they ran counter to the "budget crunch" forces. A VORTEX science department head complained that "they've cut the heart out of our elective program" with the budget cuts.

In spite of "budget crunch" backlash, new methods of course delivery were being tried out to in some way draw students to science. In our urban trial site, a science coordinator told us:

> *There's a growing emphasis on the mini-course. Some courses are offered in different packages--for example, a twelve-week package, an eight-week package. Maybe they're the old units we used to teach out of a biology course, but we're going to have a mini-course in plant growing, or photosynthesis. There will be a different breakdown in the curriculum. Maybe we're doing it because we have to compete with the other subject areas. So many other kinds of exciting things being offered to them. We can offer as much if we perhaps modify our approach.*

Practical Science ("Survival Science"). In all science courses, in particular the general science courses, there was often an emphasis on "things that will be useful in every day living."

Steve, a high school junior from BRT, said (p 4:20):

> *I think science helps you find out about yourself, what you can and can't do with your body . . . I eat more bread and milk than I used to since taking Biology when we studied calories. If you're healthy, you live longer, and I want to stay around as long as I can.*

Many parents showed a similar concern with the practical side of science. A parent during one of our site visits spoke about science education directed to personal safety:

> *Is it feasible for the National Science Foundation through its education programs to help establish programs, including effective retraining programs, so that people can be better trained in [the] hazards of the new agricultural technologies?*

Many high school level basic math teachers were concerned with providing their students with the skills and abilities necessary for the routine day-to-day responsibilities of the average adult. The URBANVILLE math chairman talked about the thrust of his program:

> *We made a list of sixteen survival skills, and with those survival skills we tried to pick out the mathematical concepts that were necessary and we designed a test, for one thing, to measure the students on those particular areas. And then we were to . . . come up with some techniques with "hands on" type materials . . . that would give the students an opportunity to visualize a certain concept rather than to have it abstract.*

In addition to personal survival, we found a concern for survival of society as a group in our site visits. The following quote is from the BRT case study (p 4:42):

> *Our students have to think in terms of a world a little larger than this community, so far as problems are concerned. We had this film the other day in sociology, Black and White Uptight. A good film on the race issue. The class didn't want to discuss it.*

A site visitor in PINE CITY expressed a desire in making the general population ecologically aware as a means of preserving the physical environment:

> I'm concerned that we should teach all of our citizens. . . the things in life that are of value, the natural things we should not destroy, that we should appreciate and that we can use, both professionally and recreationally. Making people aware of the shortage of natural resources is a very difficult thing.

"Science for the citizen" thus appears to mean somewhat different things to different perspectives. All of the sites show signs of what NSF has termed "scientific literacy" and we have renamed "science for the citizen." Interest in providing science that relates to everyday circumstances was found in all sites. Courses and curriculum were centered in many cases around practical concerns to which some scientific knowledge is germane. "General science" was found not only in general science courses but also in the specialized sciences such as physics and biology.

Science education is involved in making useful what has often times been characterized as abstract and esoteric. This was well stated by a physics teacher from FALL RIVER (p 2:7):

> *In recent years I've wondered if you could justify it [physics]. Earlier I would have said that physics was a part of cultural knowledge, something enormously practical, like all sciences having something philosophically to offer the public, an intellectual integrity which could carry over into politics and society.*
>
> *Now I don't know. We live in a technological society so it is necessary to propagate information to some parts of the society. But for the general person in high school who will eventually go into business or become a homemaker, they really don't need to know about physics, except in a very superficial way. If you want a kid to know how to change a tire, you teach him about levers . . . I'm a good sailor and I apply my knowledge of physics, but other people are better sailors and have no physics background.*
>
> *That is too pessimistic. Let me state it this way. Everyone deals with nature. Every high school student knows a great deal of physics and the teacher merely encourages him to abstract his knowledge to form more general and sometimes more useful patterns of thought. If the student can deal with ideas in the abstract, he learns this before going to college and can thereby make a sounder choice of careers. He may not do better than another competent college student, but he has had the benefit of guidance and proven academic discipline. Finally, and this is important for all ability ranges of students, a sense of being at home in the universe . . . The physical world and the technology of man must be dealt with as an important part of the total culture he is to inherit.*
>
> *My greatest contribution is to get students to grow intellectually as much as possible. If a kid doesn't appreciate a subtlety of physics it doesn't bother me. I'd like to bring each kid as far as he can go. What I'm definitely not doing, but used to do, is to prepare Ph.D. physicists. I was looking for that occasional student--but he only comes around about every four years, and running the class at that level . . . that's no longer how I want to work.*
>
> *I don't think that this [less rigor] hurts the college-bound. From the statistics I've seen it makes no difference in college freshman physics whether the person has had physics in high school or not. How he does in college is more dependent on his intelligence and motivation rather than his high school preparation. . . .*

Chapter 13

THE K-12 CURRICULUM

One parent told us, "I do wish all the school systems were taught at the same level." To the child transferring to a new school, the new courses may look frighteningly different, with regard to subject-matter content as well as with regard to the level at which they are taught. To some visitors to schools around the country during the 1976-77 school year, the courses looked very much the same. Individual teachers did things differently; standards of acceptable performance did vary; the circumstances of learning were of 57 varieties--but the textbooks were the same (see the final section of this chapter); the tests were the same; and the country had--not a nationally imposed curriculum--but local acceptance of a nationwide curriculum. The "effective" curriculum that each child confronted may have differed immensely at two adjacent desks but the formal curriculum the school district offers was almost constant across the country.

The principal purpose of beginning the reform of curricula in the mid-1950's was to give local districts or individual teachers an opportunity to choose other (particularly more disciplinary-conceptualized) curricular offerings. The movement apparently succeeded in that aim*--even though it turned out that for various reasons, except in biology, districts and teachers usually did not choose the new materials. We believe we have, in Chapter 16, some particularly useful insights into the reasons for their preferences and will outline them briefly here so that the reader can keep that in mind while considering in this chapter the subject matter that was being taught in the mid-1970's.

The uses teachers made of subject matter in their craft, while usually "justified" in terms of learning goals, were often far removed from the learning goals of the curriculum developer, the education theoretician, or the methods specialist. Parents and administrators had particular interests in how the teacher used subject matter. If Johnny or Suzie felt treated unfairly in being asked certain questions in class, he or she was upset. If parents felt that essential content for college preparation was being underemphasized, they complained. If administrators found that the teacher was not oriented toward respectable course objectives, they wanted to get things straightened out. Those folks had their goals, and the work of the teacher had a lot to do with whether or not they reached their goals.

But the teacher also had goals--survival, staying out of trouble, feeling good, not getting transferred, helping kids get ready for something, etc. The teacher sometimes punished misbehavior by having Johnny or Suzie stay in during recess and work ten extra arithmetic problems. It was not because course-content is epistemologically linked to maintaining control of the classroom--but the teacher had to do both, so why not do them together? To "just keep going," teachers found they had to use subject matter in ways that were not discussed outside school (techniques for which new teachers are ill-prepared). These maintenance techniques, mastered and depended on, then were threatened by the new innovative learning materials and methods. The innovators did not use subject matter in the way this teacher did.

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*Robert E. Stake, "The Legacy of the Curriculum Development Movement" (Paper delivered at the AERA Annual Meeting, New York, NY, April 7, 1977).

Education does not have an adequate theory of instruction* now for analyzing and planning and dealing with the diversity of uses of subject matter we found in the classroom. The rational perspective was nicely dealt with by Smith and Meux "logic of teaching" and the personal culture of teaching also in such writings as Smith and Goeffrey's "ethnography of the urban classroom,"** but none of these dealt sufficiently in 1977 with the influence of social, political and economic influences on courses taught in school. In particular they did not sufficiently connect the task-analytic frame of mind (required by the current management of schools) with what subject matter scholars thought the content of the curriculum should be.

The critics of course content improvement efforts of the 1960's tended to overlook the nature of these problems in the late 1970's. According to James Fey (interviewed by Gina Bari Kolata), John Goodlad, and Donald Schön,*** for example, the developers failed to comprehend the necessity for gradually preparing teachers to try out the new ideas. That is true, but a truism. Those curriculum developers who did go to great effort to secure sincere commitment of faculties, administrators and parents to a new program usually found that their innovations had a longer life in schools, but even there the spread was slow and the counter-pressures ultimately prevailed.

In the eleven districts in which we placed CSSE field observers, classes in science, mathematics, and social studies using innovative materials were relatively rare. Inquiry teaching--featuring teachers thoroughly trained in institutes and elsewhere to ask leading questions and promote personal exploration--was noted in just three classrooms. Only a few teachers remained enthused about those innovations, most disparaged them and appealed for "a return to the basics."

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*See Richard Snow, "Individual Differences and Instructional Theory," Educational Researcher, 6 (November 1977): 11-15.

**B. O. Smith and M. Meux, A Study of the Logic of Teaching (Urbana, Illinois: Bureau of Educational Research, University of Illinois, n.d.); and Louis M. Smith and W. Geoffrey, The Complexities of an Urban Classroom: An Analysis Toward a General Theory of Teaching (New York: Holt, Rinehart and Winston, 1968).

***Gina Bari Kolata, "Aftermath of the New Math: Its Originators Defend It," Science, 4 March 1977, pp 854-857; John I. Goodlad, Frances M. Klein and Associates, Looking Behind the Classroom Door, 2d ed. (Worthington, Ohio: Charles A. Jones, 1974); and Donald A. Schön, "Whatever Happened to Curriculum Reform?" The National Elementary Principal 56 (September/October 1976).

The emphasis on a "basic skills" curriculum was an almost universal finding in these case studies. It will be discussed at length in this chapter. A look at the case studies in terms of the relationships between curriculum development and student performance testing will be found in Chapter 15. What comes next is a separate review of three subject matter areas: science, mathematics and social studies. In this chapter we will also discuss "curriculum out-of-school" and materials of instruction.

Science

BIOLOGY-CHEMISTRY-PHYSICS

As one reads through the case studies one is struck by the diversity of the many opportunities to learn science. This diversity existed within school buildings and departments, mostly as a difference among teachers, as pointed out by Mary Lee Smith in her concluding remarks in the FALL RIVER study (p 2:41). Some differences were found at the district level. FALL RIVER offered as many as eighteen different science courses in a semester. PINE CITY and BRT, on the other hand, offered as few as five courses, always depending on meeting minimum enrollments. ALTE had elaborate sequences of science courses designed to meet the needs of students with different career aspirations.

Less obvious according to statistical studies but greatly obvious to observers were the extent to which course content, format and teaching method differed among individual science classes. Even though teachers might use the same texts, they improvised to such an extent that two otherwise seemingly identical courses look greatly unalike. Examples of this are sprinkled throughout the case studies. One could not avoid the inference that teachers develop and follow their own guidelines.

The teaching styles and strategies employed by teachers are at least as varied as the contents and formats of their courses. Some employed Socratic inquiry and denounced laboratory investigations (RIVER ACRES, p 1:92); others praised laboratory investigations and admitted they had difficulty asking the right questions (BRT, p 4:10). In any event, teacher autonomy with regard to what is taught and how it is taught appeared widespread and should not be discounted by anyone concerned with the status and/or improvement of science education in the United States.

Despite the diversity in programs, content and methods, there are factors or trends that seemed to be universal. In every site courses identified (or identifiable) as biology, chemistry, and physics were offered. These courses usually appeared in the same sequence: biology--chemistry--physics. (In the one instance where the sequence ran biology--physics--chemistry, VORTEX, p 10:9, it was interesting to note that the chemistry teachers were the longest-tenured and most established people in the science department.) More often, chemistry and physics were usually offered as electives. Biology was often a required course, sometimes preceded by general science, physical science, or earth science. As we were reminded in a NEWS NOTES TO PARENTS from a district near Milwaukee: "All students must take biology because it is a lab science, and we are committed to exposing each student to the processes of the laboratory."

As one might expect, given the above sequence and requirement-elective format, most students would take biology, relatively few take chemistry and very few take physics. Consistent with this breakdown, we also found only the most able students enrolled in chemistry and physics. Physics was described as one place on the "top of the pyramid" (RIVER ACRES, p 1:90). It appeared not uncommon for chemistry and especially physics teachers to feel that their courses are for the academically elite and to feel there is no need to try to increase enrollments (URBANVILLE, p 5:5).

A trend that seemed to be occurring, possibly related to the elitism discussed in Chapter 12, was a decline in enrollments in chemistry and physics. Several schools had been experiencing such a decline for several years even though in 1976-77 the total high school enrollment decline had just begun its decade of decline.* Enrollments in these academic electives was dropping faster than enrollment in science courses in general (VORTEX, p 10:10). What explanations did we hear?--more competition from other elective courses; the image of science and scientists is bad (reported in one school, FALL RIVER, p 2:7ff); reduced graduation requirements; opportunity to pick these subjects up in junior college, if needed; and the perception of high school students that the content of physics and chemistry are just not relevant. Undoubtedly the individual teacher plays an important role in attracting students to his/her courses. In an instance (WESTERN CITY, p 7:23) where physics enrollment showed a slight increase after several years of decline, the physics teacher was settling into her third year and was highly respected by students.

In our CSSE survey, we asked three groups about things that are wrong with high school science courses at the present time. We asked high school science teachers, high school counselors and high school seniors. They could check as many things as they wished from the things we listed and add others. The results were as follows:

RESPONDED:	101 of 150 Teachers	46 of 86 Counselors	375 of 375 Seniors
__Too much time must be spent on remedial mathematics	63%	29%	19%
__Too much time must be spent on teaching reading	48%	15%	11%
__Too little attention is given individual students	34%	20%	36%
__Too little help is available to the teacher with teaching problems	41%	20%	21%
__Class periods are too short, classes too large	62%	16%	22%
__Lab facilities or field arrangements are inadequate	51%	73%	34%
__The public and administrators are pushing for the wrong things	45%	6%	20%
__Other	19%	25%	23%

(Percents based on those responding; percents are weighted; standard errors are available in Chapter 18.)

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*We asked science curriculum supervisors to what extend enrollments in science changed in the last five years. Of 200 sampled, 132 responded but 14 of these disregarded the question. From the remaining we categorized their statements (and weighted them by the RTI sampling plan) to get the following projections:

in 18% of the districts an increase in science enrollments
in 48% of the districts a decrease in science enrollments
in 21% of the districts stable science enrollments
while in 12% of the districts the picture was something else.

The teachers in our sample were inclined to mark three or four weaknesses whereas the counselors and students one or two. The teachers pointed to things that impeded their teaching, particularly remedial instruction in mathematics and the shortage of time and size of the class. The counselors were particularly impressed with inadequate lab facilities and field arrangements, and students and teachers took note of that too. The shortcoming most noted by senior students was the little attention given to individual students. These responses confirmed observations made in the case study reports.

We asked the senior students in twenty-eight districts around the country what they considered the one thing most wrong with the science courses they had taken. The number responding was 336. Using percents weighted according to the RTI sampling plan we found that

29% checked that "the courses were boring"
24% checked that (the courses) "overemphasized facts and memorization"
19% checked that there was "not enough lab and project work"
15% checked that the "books and equipment were inadequate"
7% checked that "the courses were impractical"
7% checked that the courses were "too much aimed at the 'bright' kids"

We also asked them what they considered the one thing most right about those science courses. The number responding was 342. We found that

22% checked that "(the courses) stressed the basic facts"
20% checked that "the courses were interesting"
19% checked that the "books and equipment were very good"
19% checked that the "classes have been small"
14% checked that "they stressed fundamental ideas
6% checked that "the courses were 'down to earth'"

These data gave us the impression that the students were sensitive to and divided on the issue of stressing the "basic facts" in high school science. Some liked it, some did not. Charges that the courses were undesireably elitist or impractical did not get much support from these students.

ELEMENTARY SCIENCE PROGRAMS

Most schools we studied had some written policy about what and how elementary science should be taught (URBANVILLE, RIVER ACRES, FALL RIVER, ALTE), but what actually was taughtwas left largely to individual teachers (BRT, FALL RIVER, RIVER ACRES). By and large, the elementary teachers did not feel confident about their knowledge of science, especially about their understanding of science concepts. Even those few who did like science and felt confident in their understanding of at least certain aspects of it often felt that they did not have the time nor material resources to develop what they thought would be a meaningful program (ARCHIPOLIS, p 9:3; WESTERN CITY site visit report Weller. As a consequence, science had been deemphasized at the elementary school level, with some teachers ignoring it completely.

When and where science was formally taught, the instructional material was usually taken directly from a textbook series (URBANVILLE, ARCHIPOLIS, RIVER ACRES, FALL RIVER). The method of presentation was: assign - recite - test - discuss (ARCHIPOLIS, p 9:3).

The extent to which the emphasis on reading and textbooks pervaded the elementary science program is illustrated by an episode observed in an elementary life science class where the teacher opened a recitation period with the question: How do we learn? A chorus of students replied: We learn by reading. Exactly the same liturgy was heard in another elementary school there (p 9:9).

Other than the fairly common practice of learning science by reading from a textbook series, the selection of what was to be read and the actual time spent on reading science varied greatly from teacher to teacher. In most of our school systems, no district-wide elementary science program was identified. (FALL RIVER, BRT, WESTERN CITY, RIVER ACRES, URBANVILLE.) The outstanding exception was ALTE.

A junior high principal in VORTEX whose career had been identified with science education commented on elementary school science (p 10:10):

> *Teachers are very uncomfortable with science. You really can't blame them. Personally, I think instruction in science should be left to the upper grades. About all you can ask for is solid preparation in reading, especially comprehension, and mathematics when they reach you in the junior high.*

Junior High Program. The middle and junior high school science programs operated at least somewhat more effectively than the elementary school science programs. As a rule the junior high schools were departmentalized with a teacher designated as a science teacher. The middle schools usually were not departmentalized and a teacher usually taught more than science. But in each there was a time scheduled for science courses. The general content of these courses can usually be inferred from the course titles, as the following chart shows.

SITE	GRADE 6	GRADE 7	GRADE 8	GRADE 9
ALTE		Life	Physical	
ARCHIPOLIS		Physical	Physical	Biology or Physical
GREATER BOSTON				
BRT	Behavior & Intro to Bio-Elect-Astron	Bio	Earth/Chem	
FALL RIVER		Life	Earth	Physical
PINE CITY		Gen Sci	Bio	
RIVER ACRES	General	Life	Earth	
URBANVILLE		Bio (1 sem)	Physical (1 sem)	Oceanography or Earth (electives)
VORTEX		Life	Physical	Earth - Space
WESTERN CITY		ISCS	ISCS	

However, if the visitor read only the course catalogs and timetables, he/she was apt to get the wrong impression of these programs. As with the elementary science programs, what actually happened in the classroom was left to the discretion of the teacher. There was very little agreement (as perhaps there should not be) on what should be included in a junior high science course.

The philosophical orientation of the teacher played a key role in determining what content was taught and how it was taught. The junior high teaching ranks were composed of many former elementary teachers with a "whole child perspective" who had "moved up" and many "subject oriented" high school teachers who had "moved down" from or were waiting to "move up" to high school teaching. But according to our observations it would be incorrect to characterize most as oriented to another kind of school. Most teachers were focused on the special problems of this transition period between elementary and high school (ALTE p 3:34). How they approached these problems was largely a matter of individual choice on the part of the teachers. There was very little attempt to articulate courses with the many learnings different students have had in elementary school nor with what they would be expected to take in high school, though most teachers felt that more articulation should occur (RIVER ACRES, p 1:41).

OLD SCIENCE NEVER DIES

The three classes of levers, Ohm's Law, the five steps of scientific method, the electron shell model of the elements, the coefficient of friction, the coefficient of elasticity, converting pounds to slugs, the parts of the eye, the life cycle of the bean plant, the stages of mitosis, and the complete biological classification of a mosquito, an anthropoid, a pine tree, and Euglena have been in the school curriculum a long, long time--fifty years at least. Their centrality in the disciplines from which they came has waned considerably, as more general theoretical principles have been discovered. Yet, they were traditional elements to be learned--more for their extrinsic than intrinsic interest or value. Their existence in the curriculum was easily rationalized in terms of knowing what people are talking about when they refer to these things they studied in school. As one might suppose, the management of such traditional elements in the curriculum has long since been worked out to a fine precision.

However, for most of today's pupils, these classical topics appear dull and outdated --in contrast with the kind of science one picks up on "Star Trek" or "The Bionic Woman." Teachers sometimes blame television for the lack of interest students have in the basic scientific curriculum; they seldom delight in the new interests and excitement it has created in many areas of science: the space frontier, biological engineering, the environment, and psychology, for example. What do you do with the "tried and true" curriculum today's adults were exposed to and expect to have taught to today's youth? In most schools passing on the lore studied by the present adult generation was a prime responsibility. It could not be dismissed by calling attention to revolutionary developments in modern science and technology.

New Science Complicates. A fairly pervasive "non-trend" in CSSE science departments was adoption of laboratory-oriented NSF sponsored science curriculum projects--despite it being a sample of schools that in at least some ways demonstrated a willingness to consider new things (allowing access to our case study project, for example). A review of the sites where physics projects were specifically mentioned will bear this out. A teacher in BRT taught PSSC once, liked it, but felt it was too "risky" to use with her present students (p 4:10). In VORTEX, the physics teachers used a modified version of PSSC for their "top" physics classes (p 10:9). A physics teacher in FALL RIVER taught PSSC for a few years, disliked it and discarded it in favor of Harvard Project Physics which was still in use part of the time (p 2:7). At one time PSSC was used in URBANVILLE, but Holt-Rinehart-Winston's Modern Physics was "now being tried and probably will be adopted" (p 5:5). The physics teacher in WESTERN CITY was using a combined version of PSSC and HPP (p 7:24) (but he was planning to leave teaching this year). In RIVER ACRES the physics teacher knew about the new physics curricula but rejected them (p 1:92). In PINE CITY Rob Walker felt that given the present resources, it would be out of the question for them to attempt to teach any of the NSF sponsored laboratory-oriented courses (p 6:23). The story would be similar for biology or chemistry.

Unlike the mathematics curriculum and teaching, the natural sciences are expected to be interesting to pupils. As indicated late in Chapter 12, many new topics have been introduced. At our CSSE schools we did not find a single credit course on "recreational mathematics," but we found a number of recreational science courses. We found ornamental horticulture, mushrooms of the local forests, nature walks, nature camps, photography, and an electronics course with an orientation to amateur radio, all carrying credit toward graduation, all rather comfortably.

In these schools we saw mathematics as very serious stuff. Science, however, was encouraged to support a lot of hobbies (though hobby clubs were less common than they had once been). Mainline science, of course, was serious stuff too, especially if well filled with traditional content.

One complication was how to decide whether these more peripheral science courses should be classified for college admissions. Are they laboratory science? Some high schools had solved this problem by requiring only one year of a laboratory science and leaving the recreational sorts of science courses as electives for students who were interested in them.

There are other problems with these courses. Recreational science though often a combination of traditional and newer science topics usually involved out-of-school activities; thus creating problems for the counselors and schedule makers. The courses cut across tracks or levels they generally pre-requisite. The classes had more heterogeneous student enrollment, though with interests aroused, this was often not a problem. They depended on special abilities and interests on the part of teachers, not at all guaranteed by the teacher-education or certification criteria. Recreational science complicated things for administrators (and teachers and parents) who like an orderly shop--but they seemed to enthuse teachers and students.

There are whole new sciences and brand new theories in science. Some of these had come into the schools. Oceanography, ecology, tectonic plates, and above all, molecular biology, are aspects of the new sciences that had entered the curriculum fairly widely, both in the form of separate new courses and as units, chapters, or special topics within traditional courses. Part of their interest may lie in their relevance to human life, nature, the planet Earth. At FALL RIVER and URBANVILLE new courses in ecology and marine biology had been developed. At PINE CITY and ARCHIPOLIS ecological topics had found their way into older courses. In another of our sites, there was a new ecology course, and also a new, alternate high school with all science courses related to outdoor work. There the outdoor camping started in elementary grades and was continued on a larger and larger basis during junior high school years.

In RIVER ACRES a junior high school science department chairperson spoke of her enthusiasm for teaching tectonic plate theory. Most of the new-science innovations, like the recreational science courses, were started by teachers with particular interests in the topic in question. A district-wide outdoor education program in ALTE was strongly supported by administrators expressing a desire for all teachers to participate so they could see their pupils in different situations than in the classroom. There are some major switches in pupil competence from the classroom to the forest camp. In general, students' enthusiasm was high for outdoor and for "challenge" types of programs. (See also information about the "Walkabout" Program.*) ALTE (pp 3:49-54)

One observer watched a fifth grade class doing the arithmetic of menu planning for their forthcoming campout. There was none of the boredom characteristic of another arithmetic lesson in the same class in which the problems being worked were from a textbook. In the textbook, even the author's efforts to arouse students' interest were somewhat thwarted by the teacher's simplification. For example, astronomical distances on one page were converted to small numbers by crossing out zeros, in order to get the correct arithmetic operations without getting lost in the large number of zeros.

Not all of the schools studied showed imagination in expanding the curriculum in topical areas likely to interest children. In RIVER ACRES, WESTERN CITY, and VORTEX, there was very little of this expansion. At BRT there was some. In COLUMBUS the emergency topical expansion through television, radio and field trips quickly subsided into routine textbook science.

New science topics in the curriculum create problems for laboratory and demonstration work. Rarely are they suitable for the traditional formula of laboratory work: arrange material or equipment, observe phenomena, record phenomena (tables, graphs, drawings, etc.), interpret observations by answering questions. Working with structural models of molecules, studying eco-systems in the field, maintaining a balanced aquarium, developing film or prints, constructing an electronic circuit, etc. All lack the adaptability to the standard laboratory format that the old science topics fit. If the format changes to accommodate these interests, then where is the rigor of scientific method?

The teacher of secondary school science is likely to take the traditional formulations of method more seriously than the university science professor. Although new science programs have introduced topics which call on the theoretical imagination more than they do on empirical observation, they have not always been accompanied by a clean rationale -- the (or a) method of science. For example, one of the frequent complaints against the Chemical Bond Approach, still heard in some of our sites, was that it violated scientific method by presenting theoretical models before it presented data that supported it. This problem is not likely to go away, with the demise of the CBA. University chemistry courses have increasingly adopted much of the CBA approach and dropped required laboratory work. (High school CBA chemistry may have simply been an idea two decades ahead of its time.)

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*Maurice Gibbons, "Walkabout: Searching for the Right Passage From Childhood and School," Phi Delta Kappan 55 (May 1964): 596-602.

SCIENCE ARTICULATION

It is not at all a new observation that teachers complain about the lack of preparation their students received in earlier grades. Secondary school science teachers complained to our field observers that elementary schools are so busy teaching children how to observe that they don't teach them much content. This was not fully supported by our observations in elementary schools, but probably reflects the purpose secondary school science teachers felt to cover both old and new subject matter. This pressure arises from the kinds of concerns we have already mentioned to make science interesting and to preserve the traditional content and method, but also from the increasing amount of content covered in undergraduate science courses at universities and colleges in which the teachers were enrolled. It involved them also in an upward articulation effort (see Chapter 14 for more on articulation), to prepare those students who are going to take science in college or university for the obligations they will encounter there.

One explicit expression of the upward articulation of high school to college science is the attention given to advance placement courses. Teachers and department heads in most of our CSSE high schools pointed with pride to the courses by which some students hoped to "proficiency out of" four to six hours of college chemistry, biology or even physics. Even if they fail the proficiency tests, the students taking such courses have the advantage of having covered the material once already thus making it more familiar and less of a strain to learn.

We do not know of college professors who encourage this, but it is clear that parents of "college bound" students often do. Inevitably, it seemed, mainline science in both secondary schools and colleges was becoming less reflective and more a matter of information storage and retrieval. This judgment might seem to be running counter to the strong increase in theoretical elements such as molecular biology, chemical bonding orbitals, and tectonic plate movements. These are prime examples of theory intended to provide explanations of the myriads of descriptions of forms and processes of traditional biology, chemistry, and geology. However, unlike the theory of mechanics or electricity, the connections they have with data observable in the high school laboratory are much weaker, if not totally beyond the reach of standard algorithms. More heuristic thinking is required in such theoretical models. Written descriptions of data and arguments supporting these theoretical elements are not only difficult to provide, for they too are shot through with theory, but increasingly are omitted altogether in favor of authoritative statements that scientists have collected data which support these ideas. This is not a new problem, as Wagenschein* noted in connection with what he called the "Copernican Slogan"--the earth is a planet that revolves around the sun--a statement accepted without question by most people without their being able to give any evidence at all to support it.

Articulation with mathematics continued to be a problem for physical science teachers. It was not just that students did not know how to do ratio and proportion or to solve simple algebraic equations when they put in the context of physical quantities and real apparatus. It was also that increasing use was made of mechanical ways of routinizing the operations, e.g., the cancellation of units in quantitative chemistry problems, the use of formulas that link the quantities in a verbally stated problem, the use of slide rules or calculators. These were all ways of getting science problems solved without thinking through the mathematical ideas involved. The more theoretically oriented mathematics textbooks did not help this problem, because science teachers were generally even more likely than mathematics teachers to put aside the niceties of mathematics.

In summary, the content of the natural sciences taught in schools was increasing in scope and theoretical level, creating problems that appeared not to have been dealt with adequately by curriculum developers, administrators, or teacher educators. Mainly, these problems were being worked out as best they could by teachers--with limited help from science supervisors. However, when teachers talked to us about these problems they said they found no one very willing to listen.

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*Martin Wagenschein, "Wissenschafts-Verstandigkeit," Neue Sammlung 15, no. 4 (1975): 315-327.

Scenario Z. We found a variety of responses of high school youngsters to the science program. Some approved an elitist viewpoint, some wanted a more vocational orientation, some were bored, others expressed--as would be expected--a concern about their own abilities to understand things. We wanted to get a response from school people regarding these student perspectives so we created one of our scenarios around snippets of conversation we heard at the various sites. Then we used the mood of this conversation as background for asking questions about scientific literacy, proficiency diplomas and the role counselors play in steering students toward or away from science. We presented this scenario to high school science teachers, high school counselors, and high school seniors, and got responses as indicated on the following pages:

Scenario Z

Four ninth grade biology students waiting for the afternoon bus:

Ann: Sure it would be fun to be doing something, but lots of kids don't want to dissect frogs.

John: Ridiculous!

Laurie: I can't stand killing insects and pinching them to a board.

Tania: Next week we're going to watch plants grow. What do we do while we wait?

Laurie: Probably bookwork.

Tania: More hassles! There's not enough time to study at school. And they won't let you check the books out, so I can't study at home. So I flunk. Biology is too hard. It should be at the tenth grade.

John: There should be better "filtration." Not everybody should be allowed in the course. If you're going to take biology you gotta be willing to work.

Ann: That's what Mr. Mueller says. He says when we get to physics we will really have a good class because only the best students will be there.

Tania: But that's why it's so hard. My courses are too hard already. The kids who don't want to study have already gone into Art and Psychology.

John: Dumbhead courses!

Laurie: In seventh grade all the kids are mixed together in a big group, and then it splits--like that "mitosis" stuff, y'know.

Tania: Well, I want to be an obstetrician. I'd like to study birth and everything and sex education. You know, films and that sort of thing. Just reading from a book you don't get enough information. They use all those humungus words, all that Latin! Yuk!

Scenario Z

1. Are the feelings expressed here typical of opinions held by students in your first-year biology classes? (If not how are they different?)

Number Sampled	Returned Questionnaire	Omitted Item		Said "yes"	Said "no"
375	375	18	Of 357 High School Seniors	65%	35%
87	46	4	Of 42 High School Counselors	43%	48%
150	101	8	Of 93 High School Science Teachers	63%	31%

Among those who said "no" the following differences were noted:

A student in South Meriden, Connecticut: Kids don't really care about what they're learning. They are just worried about passing.

A student in Gordon Road, Georgia: In my first year biology class the feelings were good.

A teacher in Medfield, Massachusetts: They (our students) have been motivated in Grades 4-8.

A teacher in Perryman, Maryland: (We have) adequate study time in class; all students have a book; (and we have) numerous labs.

A counselor in Alma, Wisconsin: I have found that student attitudes about Biology vary with 1) their ability, 2) their motivation, and 3) their teacher.

2. What do you think is the principal cause of student dissatisfaction such as this? (Check one.)

	61 of 101 Teachers	39 of 46 Counslrs	264 of 375 Seniors
___boring lessions	8%	13%	31%
___insensitive teachers	10%	13%	3%
___incompetent teachers	3%	13%	6%
___their own immaturity	39%	28%	19%
___subject matter is irrelevant to student lives	20%	21%	21%
___unrealistic assignments	5%	5%	6%
___inadequate books	0%	0%	3%
___inadequate lab equipment and supplies	3%	8%	5%
___it's just talk; they aren't really distressed	12%	0%	6%

Scenario Z

3. Are there some important changes that could be made in science courses so that such students would like them more and get more out of them? What changes?

More lab opportunities were mentioned as important by a large number of students, counselors, and teachers. Among other comments our respondents made were:

From a counselor in Ensign, Michigan: Be more careful in explaining how this info (Science) applies to their everyday lives.

From a science teacher in Lynn, Massachusetts: Greater emphasis on lab work and the thought process associated with them.

From a counselor in Cedarhurst, Pennsylvania: Relate science to the real world. Integrate theory with reality. Science must live and the ability to apply principles is most important. Sometimes material is meaningless because students never see how theory will be used.

From a student in Newport News, Virginia: Yes. I feel that students learn more by experiments, films, and talking in class. There should be more of this done and not so much reading because the books do get boring.

From a counselor in Mesa, Arizona: Use different levels of difficulty. Our science classes are having good results with this type of scheduling on different levels.

From a student in Poway, California: Make the class more interesting.

Think about how those students at the bus stop were talking. Think about how studen you know talk about science courses. Then answer these questions:

4. Are science courses in your school too difficult?

Number Sampled	Returned Questionnaire		Checked "yes"	Checked "no"	Checked "other"
390	375	of 373 High School Seniors	13%	73%	14%
87	46	of 44 High School Counselors	15%	72%	13%
150	101	of 100 High School Science Teachers	9%	87%	3%

5. In science courses in your school, is the balance between lab or project work and textbook work about right?

	of 99 Teachers	of 46 Counselors	of 370 Seniors
Checked "yes"	64%	50%	56%
Checked "no, we need more lab work & projects."	34%	48%	41%
Checked "no, we need more textbook work."	0%	0%	3%

Scenario Z

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6. Do you feel your school should be offering more science courses designed for the "below average" student?

	Checked "yes"	Checked "no"	Checked "I don't know"
of 372 High School Seniors	45%	34%	22%
of 46 High School Counselors	47%	51%	2%
of 100 High School Science Teachers	50%	46%	4%

7. Is it more difficult for students to get good grades in science than in most other subjects in your school?

	Checked "yes"	Checked "no"	Checked "I don't know"
of 371 High School Seniors	38%	45%	17%
of 46 High School Counselors	37%	61%	2%
of 99 High School Science Teachers	36%	51%	12%

8. Do you believe that a major effort should be made to raise the "scientific literacy" of young people?

	Checked "yes"	Checked "no"	Checked "I don't know"
of 372 High School Seniors	61%	18%	20%
of 46 High School Counselors	76%	11%	11%
of 101 High School Science Teachers	96%	4%	0%

9. Should school districts set some minimum competency in science for all students to obtain in order to graduate from high school?

	Checked "yes"	Checked "no"	Checked "I don't know"
of 372 High School Seniors	51%	37%	12%
of 46 High School Counselors	61%	24%	11%
of 101 High School Science Teachers	69%	16%	15%

10. Are junior and senior science courses in your school aimed primarily at the students who will be going on to college?

	Checked "yes"	Checked "no"	Checked "I don't know"
of 373 High School Seniors	73%	15%	12%
of 46 High School Counselors	74%	20%	0%
of 100 High School Science Teachers	71%	27%	1%

11. Do science teachers in your school seem to want mostly to teach "pure" science rather than about how science is used in everyday life?

	Checked "yes"	Checked "no"	Checked "I don't know"
of 365 High School Seniors	48%	34%	16%
of 45 High School Counselors	38%	42%	11%
of 99 High School Science Teachers	34%	52%	13%

Scenario Z

12. Do school counselors discourage students from taking science electives?

	Checked "yes"	Checked "no"	Checked "I don't know"
of 368 High School Seniors	3%	78%	19%
of 44 High School Counselors	2%	94%	0%
of 99 High School Science Teachers	12%	69%	17%

The percents above are based on those who responded to the item. Results have not been weighted according to sampling plan because the groups were drawn in different ways.

Our interest in this scenario was primarily in the perceptions students had of the relevance of biology, the elitism of science courses, and the sometime incompatibility between laboratory work and personal and classroom demands. Students attributed student dissatisfaction to "boring" instruction and its lack of relevance, but teachers and counselors attributed it more to immaturity and caprice of the students. One science teacher in six, one science student in five, and one counselor in four did question the relevance of their biology instruction.

We did not find support here for a finding of exclusionary elitism. The respondents did see science as for the college-oriented and needing some minimum proficiency standards, but they believed that counselors and teachers were not trying to keep the courses "exclusive." Yet need was seen for a major effort to raise the "scientific literacy" of all young people. They did not see the teaching or grading as too difficult, or more so than in other high school subjects. They seemed to see science courses as special, and worthy of student respect, perhaps even awe, not satisfying an important student fulfillment, yet not exclusionary.

There is a bit of inconsistency here, if one believes that teachers can teach about any science idea or problem at several levels of difficulty, setting standards with regard to education the individual youngsters are getting rather than with regard to the intricacies (particularly quantitative) of the subject matter. But these respondents and others we interviewed appeared to believe that the subject matter is fixed and the tests are fixed, and that the curriculum department and teacher have little choice except between "the real thing" and "the watered down version." Science exists; science is difficult; therefore it doesn't make sense to complain that it is too difficult. To teach pre-college material, to emphasize mathematical problems, to have numerous prerequisites, and to have high standards appears not to be arbitrary and inconsiderate, but responsible. The inconsistency goes away.

We did find the teachers and others about the schools persuaded that there are "basics" in science--the main terms, concepts, relationships and problems central to the high school courses of a generation back and central to the introductory college courses of the day. What should be taught was something rather precious, not to be fooled with, not to be left to students, not to be decided by popular vote or with respect to its functional utility. Parents, youngsters, and even teachers, for the most part did not feel that they were denied consideration if they were not asked about what the courses should cover--in fact, they considered the question pretentious. They saw the science community as having long ago determined what the bases of science are, and the political community living up to its present responsibility when it declares certain of those learnings to be requirements for high school graduation.

The science curriculum of the schools was--in operation more than by definition--taken to be a set of knowledges and skills, rooted in the academic disciplines. It was to be shared in common by all students who would undertake the study of science. Though it may emphasize conviction in one classroom and skepticism in another, it was to be seen as belonging to the collective wisdom of men, a part of the culture, a property that exists outside the individual learner.

As seen by most people in the schools, science education has no more alliance with mathematics education and social studies education that it has with English education. Science was seen by many to be the subject matter of physics, chemistry, and biology, and perhaps astronomy, botany or geology, sometimes mixed together as general science.

These were seen as fundamentally different from the things taught by teachers of mathematics (even though many science teachers were forced to re-teach arithmetic and algebraic operations) or teachers of social studies. With a few exceptions, primarily in environmental education, there were essentially no interdisciplinary efforts in the sites we studied.

The circumstances varied from place to place depending on teacher personality, parent interest, and many other things. Although we found a few elementary school teachers with strong interest and understanding of science, the number was insufficient to suggest that even half of the nation's youngsters will have a single elementary school year in which their teacher will give science a substantial share of the curriculum and do a good job teaching it. A general science course was a standard offering in junior high schools at our CSSE sites. We saw an outstanding one in an open school in VORTEX.

Most high school science departments were offering biology for all students and either chemistry or physics or both for the student going to college. Laboratory work in several sites appeared to be diminishing in importance because of expense, vandalism, and other control problems, and the emphasis on course outcomes that will show up on tests. Some science courses at each site appeared to be well planned and well taught.

Mathematics

ELEMENTARY SCHOOL

In the eleven districts of the CSSE study we found little evidence of "new math" sets, hands-on materials, or area and slope models of multiplication and division. Instead, various forms of pencil-and-paper mathematics dominated the scene in the elementary schools. Materials such as those generated by new math curriculum projects (ESI, Dienes, Cuisenaire and math labs promoted under the British infant school influence) which schools had acquired earlier had either disappeared or were no longer used.

In one school in the ALTE district, the "Mini-computer" method of addition and subtraction developed by the Papys from Belgium for CEMREL's math project was being used. Interestingly, it is also a paper-and-pencil method despite being a major conceptual innovation using the binary system to represent decimal numbers. If teachers (and parents) respond favorably to such a system, use of paper-and-pencil conceptual systems might spread to higher grades and be adopted by other schools. However, it appeared to the CSSE staff that teachers and parents were much more interested in innovation at the early grade levels than at the upper grades.

A teacher in RIVER ACRES (p 1:34), who had nine years of teaching experience, commented that

> *You might as well forget about teaching conceptual mathematics to 75% of the children in elementary school. The upper level children like it. The rest are not only bored--they hate it!*

It is clearly mental discipline that is the focus of the vast majority of teachers of mathematics at all levels beyond the second grade, and even some kindergarten and first grade teachers would agree with this focus:

> *The emphasis on process may be an emphasis on explication--to ask a student to explain how she/he arrived at a solution, even a right solution, may be only indirectly related to mathematical skill or conceptualization. If the emphasis of elementary mathematics is on computation, it might be argued that the successful employment of "number facts" requires, at minimum, a recognition of mathematic symbols which order certain facts to be used. That this recognition is largely reflexive, as is a child's response to a red stop signal, argues not so much against the possibility that the reactor has not the knowledge of the meaning of the signal, but more toward the possibility that in familiar situations, no reflection on the meaning is necessary; it is sufficient and appropriate to stop--or in our situation to sum, to divide. To ask a student, who is behaving appropriately, to explain his or her behavior is unusual, unexpected, and unsettling.*

One comment we heard repeatedly was that no matter how hard teachers at each level try to prepare students for the next level, teachers at that level complain that the students are not well prepared. The complaints were made by math teachers at all levels--college through elementary.

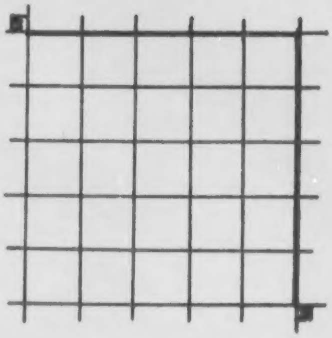
A second grade teacher said:

> *Many of these children can't remember simple number facts, like 3 + 2 = 5, but have to put down 3 dots, 2 dots, and count them all. The attachment to this method is going to prevent their making good progress.*

A third grade teacher in a school of mostly above average students reported near the end of the year that many children still had difficulties dealing with quantities larger or more complex than those they could easily visualize with the concrete materials she had used to illustrate the principles of measuring length and adding common fractions. Thus, they could add 1 1/2" with 2 1/4" but couldn't add 11 1/2' with 6 1/4', or 2 3/8" with 1 7/8". Multiplying 22 x 30 proved difficult for many children it seemed because they could not add up that many 22's or that many 30's. Six times thirty could be managed by adding six 30's, but 60 x 40 could not, even when the participant-observer, working as a teacher's aide, suggested counting by tens. Counting by tens past 100 was difficult, and that student had no idea what came after 200, when counting by 10's. The conceptual leap from concrete procedures to the general idea seemed to be one many elementary school children fail to make on their own. Teachers too often seemed unable to help children make a necessary conceptual leap.

Fun and excitement--the aesthetic approach discussed in Chapter 12 in the section on understanding--seemed to be absent from almost all elementary mathematics classes. The efforts textbook authors have made to insert challenging and interesting puzzles, problems, and topics seemed to come to no avail--with the priority of most teachers on the basic task of mastery of fundamental operations. For example:

> when a participant-observer was serving as a teacher's aide in a high-level fourth grade math class, many of the students were doing long division. They had already successfully completed multiplication with two-digit multipliers, which seemed to be an official pre-prerequisite for starting on long division even though long division only requires multiplication with one-digit multipliers.



> Several students had come to the temporary aide to get their answers checked. When they were correct, he pointed to a problem in a box in the center of the page on which they were working. None of the students tried it. It showed a map like that at the right with the route a student took from home to school and back marked out like the one shown. The question was whether a shorter route could be found. All were sure that there were many shorter routes and they proceeded to mark off several zig-zag routes between the student's house and the school. When asked to prove their routes were shorter than the one marked in the book, the students were somewhat at a loss. To them it was obvious their routes were shorter. The "aide" took them to the chalk board and offered a proof that a particular zig-zag route was just as long as the route with only one turn. This involved dividing the one-turn route into segments one block long as shown. Some students were sure the "aide" had counted wrong, and much discussion ensued which attracted several other students.
>
> As the students left for lunch, they were debating the problem, and the teacher came over to see what the excitement was about. He explained to the visitor that they never had time to do the problems in the boxes on the textbook pages, having to concentrate on the numerical exercises that filled the rest of the pages. He seemed almost not to believe that the problems like this one in the boxes were really mathematics.

What teachers at various educational levels consider to be mathematics is an interesting question. Helen Simon's site visit report (vignette p 12:11) on a fifth-grade class working on the "Peas and Particles" unit of the Elementary Science Study contained the observation that neither the teacher nor the students seemed to think that estimating in various ways the number of small objects filling a large container had anything to do with mathematics (or science, for that matter). It was seen as a challenging activity that had little to do with subject matter, "possibly social studies," one child suggested.

In elementary schools across the country we found little deviation from a traditional curriculum. Elementary school mathematics was primarily devoted to helping children learn to compute.

Articulation between elementary and secondary schools was said to be a problem everywhere. A RIVER ACRES elementary principal put it this way (p 1:38):

> *We treat them like children in the fifth and then after three summer months they become "students." Most elementary school teachers think they are there to help children with their learning mathematics and most junior high school teachers think they are there to impart mathematics to students who want it. Elementary school level 3 kids get taught where they*

> *are whereas junior high school level 3 kids get taught the same as level 2, only slower. What this ends up as is moving from slow achievement in the fifth grade to total failure in the sixth. The junior high school will say it is because they are having a tough time to adjust to junior high school. I say they aren't taught anymore. It's either them or us--one of us has to change.*

JUNIOR HIGH SCHOOL

Our CSSE site visits indicated that the goal of junior high math was to prepare as many students as possible for the high school academic track math courses. As indicated in Chapters 12 and 15 the emphasis was on preparation and performance. This should not have surprised many junior high students because, as we saw it, the goal of most elementary school teachers was to get students to master arithmetic, a "necessary prerequisite" for pre-algebra courses in junior high school. A junior high school principal's view of the articulation problem was expressed to site visitors this way (transcribed from tape):

> *I have a lot of students coming in complaining about their seventh grade mathematics teachers. They say, "Those teachers up there don't know what they're doing. I know how to get the answer. I've got the answer. It's right on the paper. They're counting it wrong, and they're insisting I show all the steps.*
>
> *And so we get into a counseling session. This is a math teacher. She's interested in processes. It's going to be that way from seventh grade on. You might as well get used to it.*
>
> *And that's one of the toughest things our teachers do at the beginning of the seventh grade in math. I would argue that if you sat in our classrooms you'd probably see a considerable amount of emphasis on the process by which kids work through to get the solution and less emphasis on the solution. Whereas, if you took a broad perspective on elementary schools, they're not trained as mathematicians. They're not going to get into any algebra and are more interested in kids, in whatever way they can, figuring out the solution to the problem, with a little less emphasis on the process of communicating the process in written form.*
>
> *In a very real way, I think it's the toughest change in terms of instruction that the kids will go through in their entire academic career, because it's the one point where the training background of the people involved in teaching them changes dramatically. From now on it becomes more and more specialized. Up until the seventh grade, you're dealing with generalists.*

We felt that this distinction was part of the mythology of the two schools, and that the difference was more one of degree than one of kind, both emphasizing operations and right answers.

At each level, of course, there were exceptions. A junior high school principal (who had once been a junior high science teacher) commented to site visitors (transcribed from tape):

> *Another problem; we teach over and over some of the most inapplicable subjects, like operations on fractions. A week after the test they can't do it again. There's no way they're going to use it. Logarithms, algebraic equations, areas of triangles--the only time they see it is in the math class. The same with invert-and-multiply fractions to divide, least common multiples, lowest common denominators, etc. We'll never solve that problem because we do not apply mathematics enough. If we start with the things we use in life, we actually do things, how much paint, how much drapery, how much material for dresses, I'd hope that we'd begin with math problems that would have some use for the average student. There's thousands of things out there.*

In answer to our question, "When are they (students) ready to pick it up because they need it?" he said:

> *When I taught physical science, specific gravity, density, the math teacher was teaching ratio and proportion. The kids couldn't make the transfer when there was anything different. The same equations with x's and y's they could just crank them out. (But) when I'd give them the same problems the next period with s, g, and d, they're lost. If you put in the units of measurement, they're lost, and you'd have to convince them they're doing the same thing! And that's where I wondered, "What are we doing?"*

On another occasion the same principal told us about moving the subject matter lower in the grades:

> *Ever since Sputnik, we've been pushing down what I would call the college level math sequence--algebra, geometry, advanced algebra, senior math, calculus. When we decided to emphasize math, the intent was to push those concepts and the understanding of that sophisticated abstraction down lower, and lower and lower, and lower. Again, I think, for most kids, that was a terrible mistake, because I don't think that mentally and maturation-wise, in terms of their cognitive development, many kids at the seventh grade can handle it. They can't handle it. If they can, they have to struggle with it. Only a very limited number--even in selected populations--is it easy for.*

In our national survey we asked junior high school mathematics teachers and elementary school mathematics curriculum supervisors about things that were wrong with the mathematics courses in their schools. They were allowed to check as many things in our list as they wished. The results were as follows:

	Elem Supr's	Jr High Tchrs
__students have been promoted without knowing basic mathematics	59%	92%
__too little emphasis given the the "big ideas" of mathematics	29%	14%
__too little attention to the "logic" students use to get wrong answers	58%	34%
__the curriculum under-emphasizes the basic skills	31%	60%
__the public and administrators are pushing for the wrong things	8%	17%
__too little attention is given the individual student as a person	20%	43%
__too little help is available to the teacher with teaching problems	25%	19%
__class periods are too short, classes too large	25%	26%
__textbooks or workbooks for basic math inadequate for older students	8%	27%

Of 150 junior high math teachers sampled, 80 returned questionnaires and responded to this item above. Of 198 elementary supervisors sampled, 112 returned questionnaires and responded to this item. The percents are weighted to estimate the national return based on those who responded to this item. Standard errors in Chapter 18.

The most apparent concern expressed by these mathematics educators was about the preparation of students in the basic skills. There was only a small expression of concern about pressure from administrators and parents, the quality of support services for teachers having teaching problems, and for the instructional materials for older students in remedial classes (a plea heard early in our visits). Elementary supervisors (many of whom were also principals or teachers) appeared more concerned about the present understanding of mathematical ideas whereas junior high teachers appeared more concerned about the present level of computation skills and more concerned about the need for dealing with the individual student as a [illegible]. These responses were largely consistent with the case study reports prepared by the observers. Perhaps the largest surprise was the high level of interest expressed here in the logic of students who are getting wrong answers.

Most of the time in the field when our observers talked to teachers and others they did talk about problems. All in all the teachers, administrators and supervisors thought that a pretty good job was being done, given the circumstances. Few parents felt that they should have been teaching for other objectives than they were.

HIGH SCHOOL

In most of our sites we found secondary school mathematics to be just as traditional and work-oriented as learning to compute in the elementary school. The judgment from mathematicians and other visiting site observers was that many of the courses were tedious. Several noted however that the students in high school mathematics classes did not appear to find them as dull, uninspiring, and irrelevant as the observers did. Teachers and students appeared to accept mathematics as a dry mechanical thing, to be done stoically. Most students took as much math as they needed as pre-requisites for the other courses, e.g., for the science courses they needed for their college major or vocational choice. It appeared obvious and acceptable to most people that the justification of the traditional high school mathematics content (algebra, geometry, trigonometry, and their continuation into analytic geometry and calculus) is that these topics prepare the student for engineering, physics, economics, statistics, and other "mainline" applications of mathematics in the world. In this sense, mathematics was a pre-vocational subject for many promising students. That mathematic experiences can be of value for other purposes seemed less important--though remedial courses and proficiency tests were treated as general education requirements.

A math teacher will tell you that the beauty, elegance, and even humor in mathematics comes from the familiarity one has with ordinary patterns--which permit recognition of interesting and unexpected deviations (see PINE CITY, p 6:36). The sophisticated teaching of mathematics in secondary schools was probably best developed in ALTE, where everything was oriented upward, toward the culminating calculus course, and teachers were geared to getting students to solve as many problems as they could. The students appeared to work hard there, yet their teachers complained in a departmental meeting that there had been a big slump in student motivation during the past ten years. They spoke of several individuals who were asking for so much (unnecessary) help that the teachers had had to ask them to start trying a little harder.

The most skillful high school mathematics teachers we observed seemed to spend their energies guiding students to solutions to set problems, much as a good tutor helps a single student solve problems assigned by the teacher. Rob Walker observed an able algebra teacher in PINE CITY. This is how he described part of the class procedure (p 6:36):

> Each student describes his/her approach to the problem and talks his/her way through the solution step-by-step. Obviously this is something they are used to doing and they talk easily and confidently about denominators, quotients, factors and terms. All the descriptions are accurate and precise and used with economy. Mr. Williams lets errors pass and tries to get the class to discover them:
>
> > "I don't understand how that can be," Jane comments on a student's solution. "How do they cancel out?"
> >
> > "Good question," adds Mr. Williams, "can you cancel from numerator to numerator? No? Right."
> >
> > "So his answer's wrong?" Jane asks.
> >
> > "Correct."

Such teaching for understanding obviously takes great pedagogical skill and mastery of the teaching materials. Those having this skill walked around a room of 20-35 hard-working students helping them discover how to attack and solve the particular problems on which they were working. With some students lazy, disinterested, or even rebellious, the problem became even more difficult, even to such an extent that the difficulty of the problems to be solved was reduced in order to keep order. (See Hassler Whitney's descriptions of students working on problems in high school math classes, to understand what the typical teacher is up against, p 16:2.)

We asked the senior students in our national sample what they considered the one thing most wrong about the mathematics courses they had taken. The number responding was 318. Using percents weighted according to the RTI sampling plan we found that:

31% checked that "the courses were boring,"
26% checked that "the courses were too much aimed at the 'bright kids,'"
14% checked that there was "not enough lab and project work,"
13% checked that they "overemphasized facts and memorization,"
12% checked that "the courses were impractical," and
5% checked that the "books and equipment were inadequate."

We also asked them what they considered the one thing most right about those math courses. The number responding was 341. We found that

40% checked that (the courses) "stressed the basic facts,"
19% checked that "they stressed fundamental ideas,"
13% checked that "classes have been small,"
12% checked that "the courses were interesting,"
9% checked that "the courses were 'down to earth,'" and
7% checked that the "books and equipment were very good."

Clearly what the students liked best about these math courses was that they stressed the "basic facts," though a small percent felt that overemphasized. It was interesting that the best thing that 13% of the youngsters could say about them (of the choices we allowed them) was that the classes had been small. The quality of books and equipment did not draw many comments. Over half of the youngsters responding found the courses boring or elitist.

We compared these responses to those made by the same youngsters with regard to their science courses (presented on page 13:5). We found the youngsters, not surprisingly, more concerned about the quality of their books and equipment in science than in math. There were fewer concerned about an "overemphasis on facts and memorization" in math than they were in science, more satisfied with the emphasis on facts and memorization they found in math. More found the science courses interesting.

When a teacher and a selected group of students from an alternative high school discussed their courses with a team of site visitors, they remarked that they had not been able to find a way to make mathematics relevant to student interest in their environment. The school was filled with projects involving crafts, oversized terraria, a herbarium, dissected animals, mounted animals and skeletons and records of bird migrations. One of the visitors suggested D'Arcy Wentworth Thompson's work on Growth and Form and described briefly how it could be applied to comparison of skulls they had prepared. It was clear from their responses, however, that this was not regarded as "mathematics." They felt they needed mathematics as future citizens, even though they had found no environmental application for the algebra and geometry they were studying. They found themselves hard pressed to defend a need for math--except that it was a sometimes useful proof that they were not escaping from the hard reality of school.

Unlike the sciences, where new topics often evoked considerable interest, almost the only topics for school mathematics that ever entered any discussions of ways of varying mathematics offerings were statistics, computer math, and "applied mathematics." Onlv the last offering was said to have a chance of full enrollment.

Many math teachers were popular teachers. At FALL RIVER, for example (p 2:10):

> Mr. Bennett is a veteran in math education, yet he still loves to teach geometry because it is a tough subject and he enjoys helping kids struggle and finally grasp it. Students speak fondly of him, yet respect his toughness.

We were convinced that getting tough, driving students to do more problems, often sets the norm of the "good math teacher." One math department chairman of a large urban high school remarked, "What I tell all my classes is this: the only practical value you'll get out of studying mathematics is to learn to do as you're told." (See Chapter 16 for further discussion of mathematics for moral training.)

The goal of high school mathematics seemed to be to get as many students as possible ready for college math, or even, as in advanced placement courses, to get them ready to enter more advanced college math courses. If they would have to take the same course over in college, then this would prepare them to make a superior grade.

Social Studies

Student response to social studies was widely observed to be apathetic. A teacher at BRT observed that "the kids look on it as not really necessary." A parent at BRT (p 4:4) said:

> *The knowledgeability of students about world and state affairs affects their response to its study. They know more about social studies than about science. So they feel they don't need social studies. This is to their credit, I think.*

Yet, half the seniors surveyed reported that their social studies courses had been interesting.

It was clear that the student had many sources of information about current social events and issues and that the school was not the most effective or pervasive source. The following classroom incident in BRT (p 4:46) suggested, however, that the apathy was not solely a matter of satiation.

> *Teacher: How many heard the Ford-Carter debates last night?*
>
> *Student: I watched 'em come on and go off and slept during the rest.*
>
> *Student: Boring.*
>
> *Student: The best part is when the sound went off.*
>
> *Teacher: Don't you think there's much to be said for enlightened citizenry?*
>
> *Student: I don't want to know that bad.*

Another indicator of low student interest in social studies was the relatively low enrollments found in the elective courses. The enrollments seemed to reflect a filling out of one's schedule to obtain required Carnegie Units more than an interest in the content. Some felt a lack of purpose and definition contributed to unfavorable student attitudes toward the social studies. To many it appeared that there was much redundancy in the material. The response of a teacher in BRT (p 4:42) was not atypical:

> *We had this film the other day in sociology. . . a good film on the race issue. The class didn't want to discuss it. I could see them shrinking--"Oh no, not that again".*

Occasionally we found a spirited or challenging social studies class. A junior class (Advanced Placement) in VORTEX (p 10:8) discussed the "assimilation" of cultures.

> A Jewish student was presenting a report on the experiences of his people. Parts of it touched on the policies of Adolf Hitler. As the paper concluded, a classmate referred to a "60 Minutes" episode the previous Sunday regarding the American Nazi Party. An interesting, dynamic period ensued, but was brought to a rather abrupt close by the instructor.

Teachers were concerned about spending too much time away from the assigned lesson--as happened so easily for competent social studies teachers. One teacher explained her abrupt action:

> *I literally don't know how to balance off current social affairs with the need to cover material. They often introduce fine examples from televised programs, yet I know that the (advanced placement) exams are heavy on content coverage.*

We asked the senior students in our national sample what they considered the one thing most wrong about the social studies courses they had taken in high school. The number of responses was 325. (The following percents were weighted according to the RTI sampling plan.) We found that:

40% checked that the courses "overemphasized facts and memorization,"
27% checked that "the courses were boring,"
11% checked that "books and equipment were inadequate,"
10% checked that there was "not enough lab and project work,"
9% checked that "the courses were impractical," and
2% checked that the courses were "too much aimed at the 'bright' kids."

We also asked them what they considered the one thing most right about those social studies courses. The number of responses was 340. We found that:

50% checked that "the courses were interesting,"
28% checked that "they stressed the basic facts,"
8% checked that "the courses were 'down to earth',"
7% checked that "they stressed fundamental ideas,"
6% checked that "the classes have been small," and
2% checked that "books and equipment were very good."

What the students clearly liked about social studies courses was their ability to hold interest. They were more impressed with their coverage of basic facts than they were with their presentation of fundamental ideas, but a very large number found the emphasis on facts and memorization the most objectionable thing about them.

When we compared the responses of these same students to courses in science and math we concluded that the social studies courses were capable of interesting the students more, but often failed to do so. The mathematics courses were clearly seen as more elitist.

In none of the three subject matters was there much praise for fundamental ideas. That could be because there was not much talk about it or that the students did not see this as a very important thing for a high school class to do.

We had heard that students wanted their subject matter to be relevant--at least we used to--but we found that courses in these three curricular areas were neither cited for being down-to-earth nor for being impractical. We believe that "relevance" was not a very high priority criterion for students for assessing the quality of courses in science, math and social studies.

We wondered how the students felt about how the social studies courses could be improved. On our national survey we asked 375 seniors, 250 of their parents and 150 of their teachers the following question:

> As you look at social studies courses in your high school and elsewhere, you probably see things that concern you. Please check those things below that you consider to be major problems. (Check as many as you wish.)
>
> (361 seniors, 148 parents, and 83 teachers responded to this item.)

Srs	Prnts	Tchrs	
47%	22%	38%	___too much emphasis on facts, not enough on concepts
13%	22%	24%	___too much emphasis on concepts, not enough on facts
12%	10%	8%	___too much emphasis on teaching about personal values
34%	33%	31%	___not enough emphasis on teaching about personal values
21%	32%	15%	___not enough qualified teachers
29%	15%	23%	___belief that teachers teaching the same course should teach the same things

Wondering how much the problems were affected by the lack of funds we asked the same people another question:

> In what ways have budget cuts in your district seriously affected the social studies curriculum? (Check one or more)

Srs	Prnts	Tchrs	
19%	23%	25%	___We have not had budget cuts recently
29%	28%	27%	___The social studies curriculum has not been seriously affected in any way
21%	20%	33%	___Classes have been made larger in size
10%	12%	10%	___Needed and highly qualified teachers have been "let go" and not replaced
30%	20%	29%	___We have more teaching from textbooks, less with material or in the field
8%	5%	10%	___No longer can we provide a textbook for each student individually
3%	1%	11%	___The inservice training program has been cut back substantially
9%	12%	12%	___Other: (Please indicate)

(The percents for both of the items above were not weighted. Standard errors are not available.)

Elementary. As a content area, social studies was found to be subordinate to reading and mathematics in the elementary curriculum. At each of the sites there was some kind of social studies curriculum, but teachers and principals readily admitted that instruction in this area was of much lower priority than reading and math. It had about the same priority as instruction in science. Social studies lessons were seen to be given more time than science by most K-6 teachers perhaps because they were more knowledgeable about social studies than science.

Curricular materials in reading and language arts were often found to deal with social studies type content, e.g., stories about things like countries and people. Elementary teachers also devoted a considerable amount of time and effort to activities that were "social studies" in the sense of teaching social skills and attitudes. (See more on this in Chapters 16 and 14.)

The use of Man: A Course of Study was found only in ALTE*. A fifth grade teacher said, "I use it. I love it." But the pupils we talked to were bored with the emphasis on baboons, and did not seem to relate the learnings to personal values of humans. ALTE was also the only site in which some attempt had been made to develop and implement a coherent social studies curriculum in the elementary schools. Other sites had developed a sequence of elementary social studies courses as part of a district plan but had not insisted on or enforced its implementation.

Some of each curriculum was informal. At an ARCHIPOLIS elementary school, site visitor Bob Stake arrived just as a bake sale was closing. Sadly, he reported it was:

> . . . sold out, having earned money for the student council for awards for an already held social studies competition.
>
> The student scoring highest on a social studies quiz had won a $25 bond. Some quiz questions:
>
> *Who is our black member of the Supreme Court?*
> *Who found more than a hundred uses for the peanut?*
> *What black man assisted in the planning and design of our city?*
> *Describe the two statues in Jackson Park.*

Helen Simons, a curriculum evaluation specialist from England, included the following in her site visit report:

> I was curious to learn how social science was interpreted in an elementary school so I attached myself as a teacher aide to one fifth grade teacher. The teacher was reputed to be very interested in social studies--the nearest formal approximation on the timetable to social science. In the event we talked as much about science and math as social science. But that was the starting point.
>
> The teacher decided that I should talk to the grade about England. My introduction soon turned into an open class discussion. Questions flowed thick and fast from the advanced group as much as from the basic group. Topics included open space classrooms--advantages and disadvantages--("It's not so closed; if you get tired of the lesson you can switch on to another," etc.,)

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*Our conclusion as to the infrequent use of MACOS was consistent with the findings of H. Russell Cort, Jr. and Nancy Peskowitz (A Longitudinal Study of Man: A Course of Study, Washington, D. C.: Antioch College, December 30, 1977). Implimentation problems and concern for controversy were not likely to be as much an obstacle as the fear that conventional subject matter would not be covered.

T.V. programmes--mostly adventure and humor (Monty Python scored highly), cars, sports, the National Health Service--this injected by the teacher--the Archbishop of Canterbury, Northern Ireland. I was impressed by their openness, their curiosity and persistence and the range of their knowledge. They told me that the war in Ireland was not only a civil but also a religious war. After I explained the National Health Service for a few minutes the boy on my left said, "So you have a socialist system there." Then one boy who had held up his hand patiently for ten minutes, it seemed, asked if I was still taking questions about cars?

> *"Sure."*
> *"Well," he went on, "is it still true that people prefer Bentleys to Rolls Royces because the standard on the Bentleys is not so showy?"*

There is no short answer. The discussion (dialogue?) which followed raised questions of values--which seemed not to satisfy John. After a few minutes the teacher broke in to suggest that he was really asking for a value judgment from me. . . .

Four children lingered for a moment when the lesson finished. I was looking at the teacher's book. One girl suddenly asked me:

girl 1	*"Does Queen Elizabeth tell you what to do?"*
reply	*"What?" (In surprise, wondering if I had heard correctly.)*
girl 1	*"Does Queen Elizabeth tell you what to do?"*
reply	*"Does Queen Elizabeth tell me what to do? . . . No, she doesn't. I listen to what she says but she doesn't tell me what to do."*
girl 1	*"Are you a teacher then?"*
reply	*"Yes . . . I was."*
girl 2	*"Who's Queen Elizabeth?"*
girl 1	*"Queen of England."*
boy	*"You sound like her."*
reply	*"Oh" . . . and they raced off to P.E.*

It was not only their forthrightness but their range of vocabulary (and in some instances, degree of understanding) which surprised me. Take the following comments on discipline from a fifth grade pupil.

> *"I don't see what parents and teachers can get out of discipline, you know. The kids will still do it whether you hit them or not. Like my parents, my Mom, she spanked me but she never hit me."*
>
> *"Violence on TV has gotten everyone into violence, corporal punishment, you know, with the stick. How's it going to stop the kid? Just a little pain is not going to stop anybody you know. I never got that. I don't see how parents think they can get away with that . . . I don't see how anyone can get away with that."*
>
> *"I'm for punishment--but capital punishment that's a big one out here. Do you have capital punishment . . . with the guillotine? . . . I'm for capital punishment. I believe that if you take someone's life that your life might be forfeited."*

What interests me is the relationship between social confidence, pupil grouping and children's intellectual development. In such a supporting setting they can (and did) make mistakes, take risks and talk through their problems without fear of censure. The climate seemed very positive for growth . . . (but) the structure of the curriculum and speed of interaction did not seem to allow for much reflectiveness or accommodation to individual differences in stages and styles of learning.

Secondary. Social studies was observed to be an important curriculum area in the secondary schools. Little concern was expressed by secondary teachers regarding the teaching of social studies in the elementary schools. Only in ALTE did we find indication of sustained attempt to effect articulation from elementary to junior high school social studies. The bigger concern of secondary social studies teachers was whether the student could read. A counselor in RIVER ACRES said: "Every social studies learning problem is at base a reading problem" (p 1:74).

The importance of social studies in the secondary school was reflected by its being a required subject for much of the secondary experience. A social studies course was typically required at each year in junior high school. The course titles in junior high were typically geography (world or some region), U. S. history, civics, and state history. We saw no evidence of contact with the High School Geography Project, Project Social Studies, the Anthropology Project, DEEP, ISIS or other course content improvement projects. Occasionally we saw a unique course, such as the Local History course developed by the teachers at ARCHIPOLIS.

In Illinois the Illinois Office of Education was promoting social studies courses called "responsibility education." According to curriculum consultant Alan Lemke:

> *Responsibility Education* directs the sense of responsibility upon two of the most pervasive symptoms of modern social problems--citizen disinvolvement and the diffusion of responsibility. . . . Because no one understands or fully agrees with modern responses to street crimes, to school vandalism, to white collar crime, and to what is often perceived as loss of faith in government, citizens disinvolve themselves.*
>
> *. . .Responsibility Education responds to citizens' disinvolvement by perceiving choice and responsibility in the individual, a perception which partially justifies and generates the sense of responsibility. Police services, medical solutions to social problems, educational programs, and welfare programs should be the tools of individuals and not merely the results of technological advancements; and to bring social programs under the control of individuals, individual choice and responsibility are assumed as major premises in schools.*

We overheard no talk about "responsibility education" in our Illinois site, BRT, during the fifteen weeks observer Alan Peshkin was there.

One of two years of social studies coursework were found to be required in the senior high school (two more often than one in the CSSE sites). The most common course titles for the required courses were World History and U.S. History. Electives were offered with many different titles like Current Affairs, Modern Problems, Government, Economics, Anthropology, Psychology, Sociology, Latin America, European History, Political Philosophy, Religion, and Philosophy. The contrast between a history sequence and a science sequence was vividly portrayed in the ALTE case study.

The articulation of the social studies curriculum was found to be weak at all grade levels. A teacher in VORTEX observed that (p 10:8)

> *Unfortunately, social science is too often seen as a synonym for a collection of courses--often lacking a sequential development--a course here and a course there--with the belief that by offering such courses, the student learns once and for all.*

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*Alan Lemke and Sidney J. Slyman, "Responsibility Education: Rethinking the Teaching of Knowledge," (unpublished paper, 1977).

The field observer in RIVER ACRES could find no underlying and unifying principle in the social studies curriculum at that site.* The social studies curriculum in ALTE seemed to be an exception in that it was evident to the field observer that the curriculum was quite well articulated with the clear purpose of developing strong understandings in the history of mankind. Even here, however, a site visitor quoted a teacher as saying:

> He agreed that even social studies did not form an integrated area, but consisted of subject specialisms pursued independently, and only loosely held together by a very general definition.

SOCIAL STUDIES AS SOCIAL SCIENCE

Few were found who argued that the social studies curriculum was social science in the sense that it emphasizes a scientific approach to social issues. The methods of the social sciences and the tentative nature of bodies of knowledge called the social sciences were given little emphasis. Responses to an item on the CSSE national survey indicated that the lack of emphasis on social science in the social studies was consistent with the priorities of the general public. Sixty-six percent of respondents agreed with the claim that:

> The general public does not put high priority on teaching social studies in a way that emphasizes a scientific approach to studying social issues.

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*One of the very first reports we received back in Urbana from our field observers (FALL RIVER) was that the high school social studies classes seemed to be heavily staffed with coaches. We checked it out, there and elsewhere, and were not persuaded. Still the question in any curricular program as to the competition with competitive athletics is worthy of attention. In BRT, the jr. high school principal was also the social studies teacher and one of the coaches. He said: "I try to think of myself first as a teacher, second as a coach, although I will admit that during the season it's very hard to do. . . . This year it was worse because the things that have to be done with coaching have to be done now; and your classroom preparation time is what's left over." a RIVER ACRES social studies teacher surprised observer Terry Denny with an unsolicited comment on this competition (p 1:115):

> *The big ideas in social studies are not the most important; reading and writing are. But if you want to know what is really important look at the instructional budgets. What's important is athletics. They can ship kids by the busloads to games, to contests, matches, whatever, because their instruction is important. We cannot take advantage of an opportunity when it pops up. When we ask for a trip for a class of students, the answer is no.*

On the other hand, there was a sense that social studies is taught as a science in the same way that chemistry, physics and biology are often taught. That is, a chemistry course in high school should teach what is known about chemistry, etc. The student then was expected to learn the facts about chemistry. The experiments were used to teach the facts rather than the process of finding out on one's own. Social studies was apparently most often taught in this same way. The content was conceived as what is known or factual. How the facts were obtained is secondary. Thus, there are five causes of World War I, the melting pot made America great, a bill becomes a law in this way, humans have primary and secondary needs, there is a law of supply and demand, and so on. It was commonly believed that in order to study the facts as temporary or arbitrary you first must have a mastery of the facts, and that was the job of the elementary and introductory courses.

The general public probably does not perceive social studies as science. The perception of the general public about what should be taught in social studies apparently was not much different from their perception of what should be taught in science. It was the exceptional teacher who wanted to run counter to this pressure. A site visitor, Frances Stevens, observed that most teachers viewed the emphasis of their teaching task to be "on the transmission of facts and skills."

Even the exceptional teacher seemed to make a distinction between social studies and social science. Site visitor Helen Simons, talked with a teacher who said:

> *I don't think I differentiate here. I think they overlap. I think. . . I guess social science would be concerned with teaching values. . . some important concepts about man and his environment whereas social studies is technically geography - rivers and their tributaries. . . and possibly. . . all geographical concepts like that I think I would classify that as social studies. But social science you really have to learn about living in a community and having values. That to me is a science.* [Where would she place History?]
>
> *I would say history is a social science too. You know why? Because if you are smart and you realize what mistakes other civilizations have made and you really try to avoid making the same mistakes that is a science. . . our values come in there. . . I think they (children) get values as you talk about these things (mistakes of other civilizations, differences in generations, etc.,) but you have to talk to these children . . . I have a big chance to talk to them when they are out playing, I watch their reactions with one another. I think that's social science too -- getting along with one another. And anything the guidance counsellor does with them is social science, too. (see also p 16:18)*

There is much potential for controversy in social studies--yet little controversy was found. The apparently dominant point of view was expressed by a FALL RIVER (p 2:13) teacher:

> *Teachers are an extension of the parent and as such should teach the value system that is consistent with the community. The community has a vested interest in the schools and has a*

> *right to demand that certain values should be taught and certain others not be taught.*

The word "truth" might be inserted for "values" in the quote. There were rare exceptions. A BRT (p 4:51) teacher said:

> *I've been accused of being a communist and an atheist. Once the science teacher and I brought two classes together to discuss Darwin. We were studying the twenties in history and talking about the Scopes trial. A few periods later a kid came by and asked if I was an atheist. These students are riled by a discussion of evolution.*

Perception of the appropriateness of dealing with controversial issues was discussed in Chapter 12 of this report. Also in Chapter 12 we reported on CSSE survey scenario Y which examined a teacher's use of repartee in dealing with a potentially controversial situation.

The safe approach was the non-controversial approach, sincerely (we believe) preferred by most teachers and parents. It was to stick to the facts, specifically those facts that the community believes and the textbook supports. To encourage questioning of facts and beliefs, to dwell on relativity and interpretation, was to stimulate controversy. Given community expectations as they are, preferences of a majority of teachers, and the responsibility of teachers to honor these expectations, it seems unlikely that the social studies curriculum will become more oriented toward being a social science curriculum than it is now.

The Basics

For a number of years George Gallup has polled the citizenry about American education. Often he asked, "What is the most serious problem?" and "What is most right about American schools?" Regularly, the response that the curriculum is "what's right," never appeared high on the list of problems. Until the last year or two. Now, for the first time, substantial numbers of people were saying that the curriculum needs changing.

The direction of change was also clear. In the latest poll over eighty percent of people acquainted with the "back to the basics" movement responded in favor of it.* In our own CSSE survey we proposed the following hypothesis and got these responses:

> The schools have been creating "new" courses and having students work on topics of their own choosing. As a result of these and other circumstances, the schools give too little emphasis to the basic knowledge and skills that every youngster should learn.

Of 179 teachers	55% said, "Yes, it's true"
Of 250 senior class students	36% said, "Yes, it's true"
Of 142 parents of seniors	64% said, "Yes, it's true"

> The "I don't know" responses ranged from 9% for parents to 18% for teachers.

> Percentages are unweighted, based on the division of those responding to the item. Standard errors are given in Chapter 18.

What is Basic? When that many people agree on a value question, it is wise to look for ambiguity, and there is ambiguity in what the "basics" are. Most people think of "the 3 r's," reading, writing, and arithmetic, when they speak of the basics. In practice, only the bare-bones technical skills of reading and simple arithmetical operations were getting primary attention in this emphasis on the basics. Interpretive reading, fundamental mathematical concepts, and expository writing were not included in the emphasis.

Many teachers of course had lists of knowledge areas that they considered basic, and they often conceptually included these when they lended support to a "more basic" curriculum. These areas were central to the structure of subject matter, including such topics as the conservation of energy, economic scarcity of goods and labor, photosynthesis, and the reinforcement of behavior. Many teachers considered the ability to study, to learn independently, to solve problems in groups, to use reference sources, etc., basic to a child's education. One of our site visitors in URBANVILLE, physicist Arnold Arons, commented (p 5:26):

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*George H. Gallup, "Ninth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools" Phi Delta Kappan 59 (September 1977): 33-48.

> I noted that the teachers we talked with (particularly the elementary and junior high teachers) seemed not at all sensitive to the fact that competent and effective implementation of the better inquiry-oriented science and social science curricula might have the potential of significantly upgrading both the language skills (reading facility and reading comprehension as well as speaking facility) and arithmetical skills of the children. Teachers who have developed some genuine competence in the handling of such materials are, in my experience, far more sensitive to the impact of such curricula on the basic skills of children, and they are less ready to regard science and social science as not having a place in the "back to basics" formula.

Many teachers noted rapid changes in social responsibility for individuals as older structures, e.g., the nuclear family, the church, and the civil authorities, change. They spoke of the "basic" responsibility of each person to exercise societal rights and obligations and the role of the school in assisting.

Joseph Cronin, Illinois Superintendent of Public Instruction, proposed a fourth "r" (as have advocates of a variety of things), this one "Responsibility Education," as described by Alan Lemke earlier in this Chapter. Here too is a strong support for "the basics" but with a special interpretation as to what is basic. The fact that we observed large differences there as to what basic education is should not cause one to slight the fact that there was at the time an immense belief that the schools could offer a better curriculum, one that does more to assure that youngsters are grounded in common linguistic skills and are knowledgable about traditional subject matters.

TEACHER BACKING

To be sure, many teachers were not much concerned about the flap over "a more basic" curriculum. In discussing "back to the basics," a large number said something like the sixth grade teacher in RIVER ACRES, Texas, (p 1:18) who answered, "Back? We never left!" It was not unusual for teachers to respond that they were doing everything we inquired about--but here at least, clearly she was correct. They were teaching pretty much what teachers across the country had been teaching in math and science in 1950.

In ALTE (p 3:14ff) the "back to basics" movement appeared to our observer to be concentrated in the controversy over IPI mathematics. Several years ago a "perceived need" for individualization of instruction--apparently rather than objection to the more highly conceptualized mathematics books being used--persuaded one elementary faculty and later an aggressive assistant superintendent to promote IPI mathematics. According to observer Lou Smith, it was more a concern for "organizational structures for coping with curriculum responsibilities" than a concern for performance levels of the youngsters, though some of the latter, of course. The program evolved. At the time of our observations district policy was that one half of the instruction would be

IPI and one half "teacher developed." The issue remains controversial at ALTE. The complexity of the situation, involving teacher autonomy, professionalism, administrative roles, competing advocacies, multiple kinds of evidence of instructional effectiveness, etc., is nicely spelled out in the ALTE case study.

We were surprised by the strength of the response from teachers, both in the CSSE survey and through our contacts in the field. We expected to find teachers seeing the call for "back to the basics" to be a threat to what they considered the proper course of study and a criticism of their work. We expected them to protest that a greater emphasis on the basics would be departure from the concepts and complex relationships so necessary for understandings in science, mathematics, and the social sciences. Some did, as shown in the survey results below.

In one of our scenarios we created a science teacher named Foster who claimed that "more emphasis on uniformity is going to erode support for the college-prep program." Although it is generally assumed that the objectives of a traditional curriculum can be preserved and pursued when a school adopts an objectives based program, we asked our respondents to test the idea against their experience. We presented the following question to three groups and got responses as indicated:

> Foster seems also to be suggesting that the science curriculum is competing with the objectives-based curriculum--rather than being supported by it. Do you feel that funding for the one, if spent properly, would support the other? Or do you feel that districts just have to make hard choices between traditional and objectives-based studies?
>
> > "The methods and goals of traditional and objectives-based curricula are relatively independent; therefore, they compete for funds,"
>
> was the answer given by: 9% of 126 elementary science supervisors responding
> 13% of 47 high school principals responding
> 43% of 43 parents of seniors responding
>
> > "The methods and goals of traditional and objectives-based curricula are highly related; therefore, they do not really compete for funds,"
>
> was the answer given by: 86% of the elementary science supervisors
> 77% of the high school principals
> 53% of the parents of seniors
>
> The remainder checked "other" and some added their alternative conclusions. The standard errors for these unweighted percents are not available. Related information is presented in Chapters 14 and 18.

As shown above, some teachers were concerned about how an objectives-based curriculum, (which to many people is a "back to basics" curriculum) will affect the traditional program. In our sites we found some in doubt, but large numbers of teachers were more vehement than parents, urging a greater stress upon the basic skills. Some seemed to imply that they had not been allowed to teach as they had wanted to, that they sought the freedom or a mandate to teach something other than what they had been teaching these last several years.

It was our observation that the teachers in all our sites had a great freedom to teach largely what they please. This was a freedom within limits--and if they approached those limits the parents or board objected. They were obligated to organize their work in most of these schools around a certain syllabus or set of topics. But in the high majority of schools teachers were not obligated to use the same tests or quizzes other teachers use. There was extensive use of packaged programs such as IPI math and Project PLAN so teachers had less leeway then. There was little direct supervision to see that they gave a certain emphasis to certain skills or topics. Rather it was generally announced and implied that teachers should teach in ways that work best for them, and not to expect to be identical to other teachers in the school. We often heard claims that this was just a matter of style, that they were all pursuing the same goals--but was obvious to any observer that in these separate styles was a great difference in intermediate goals, in the development of personalized experience and cognitive associations, and in dwelling upon the rudiments of the language arts. Thus, we found that the teachers taught in largely different styles and, at least in the short run, covered quite different ground; that they felt strongly about this opportunity and privilege to direct their own work; that most administrators and parents agreed that they should have this responsibility--yet we heard many from all groups urging a "return to the basics" and a need for more uniformity of curricula.

It seems reasonable to interpret some of the teachers recent emphasis on "the basics" as a reaction to the difficult teaching demanded by the curriculum reform efforts of the 1960's and a reaction to the poor performance record of many students. As described in later sections of this chapter, the new curricula covered topics the teachers were not prepared to teach, and some of the curricula required teaching roles (inquiry, neutral observer, devil's advocate, etc.) that were unusual, difficult, and even psychically hazardous for them. There has been public indignation about newspaper stories of students who hold a high school diploma but cannot read at grade school level. Most teachers saw these as isolated cases of students unwilling to learn, and teachers unwilling to make them; but many saw too an inflation of expectations as to what the schools should be doing diverting attention from teaching the basics.* In the RIVER ACRES, Texas case study, (p 1:196) observer Terry Denny pointed to still more and complex reasons that contribute to the vocal support teachers in our sites are giving to the "back to basics" outcry.

Raising Standards. In interviews with teachers our observers heard frequent reference to a need for raising standards. The reference here, of course, was not to a higher quality curriculum but higher quality performances of students, the contention being that teachers should insist upon better work from students. It was most frequently raised by teachers who preferred a more traditional curriculum, many of whom were also calling for a return to the basics.

It was interesting to us to note that the cry for standards was almost never expressed by those who advocate a more modernized and conceptually oriented curriculum.

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*See Carl Bereiter. Must We Educate? (Englewood-Cliffs, N.J.: Prentice-Hall, 1973).

Those people too were interested in raising standards, but presumed that the traditional course of study was part of what needs improvement. Also, those who favored matching talent and interest of the youngster within an array of electives were seldom the ones to speak of raising standards. Nor were they who advocated equal opportunity for poor and minority youth. It was primarily those who want a common, traditional curriculum for all students--one where it will be clear as to who are the "A" students, who are the "B" students, and so on.

It was apparent that teachers were sincere in their efforts to raise standards. It was also apparent that there were important side effects. In the short run, it may improve the teacher's image to be an advocate of higher standards for students. But in so doing, teachers may put themselves and their students to further disadvantage by raising false expectations for achievement. At VORTEX in Pennsylvania we heard how an emphasis on higher standards hurt in two ways (p 10:11):

> *Mathematics is dominating the junior high science curriculum (now) so fewer students choose it at the upper levels because 'they're turned off.' The 8th grade science course is so demanding! It has replaced general science as a stepping stone to high school. The latter was much better because it was a good introduction to biology, physics, and chemistry.*

Just how complex the picture was is more apparent in the case study.

Reading Skills. We found an almost universal belief that good reading skills were essential to other learnings. It is obvious to all that everybody learns many things without depending on reading, but still it was believed that important scholastic learnings are dependent on reading. Thus, science teachers and sociology teachers were just as insistent as language arts teachers on large allocations of school time for reading. Here are the words of a junior high school building principal, a former science teacher experienced with public schools and private schools.

> *Very little science is taught in the elementary grades--and understandably so. Mathematics and reading, especially reading comprehension, are the best preparation for later work in science.*

A fifth grade teacher at our BRT site in Illinois said:

> *Reading comprehension is the bridge to scientific literacy.*

In Alabama we talked with a group of black teachers who had been involved in various "remedial" programs, particularly at the freshman level. One, a former high school chemistry teacher and participant in an NSF summer institute, said:

> *Reading for understanding is the biggest need these kids have. Most math teachers concentrate too much on teaching rules, principles, and the like. But the kids can't read that well. They may perform the task, guided by oral directions, but fail to grasp the meaning of what they are doing.*

A director of a Title III project, a counselor by training, agreed:

> *Students are quick to admit their deficiencies in mathematics. But they fail to see their deficiencies in reading.*

A director of a remedial lab, long experienced with Title I, added:

> *To understand the question is to understand the answer. Students not only experience difficulty with key words, but also in detecting the influence of context on these words. In biology for example, the subtleties of distinguishing between a "correct" response and that "desired" by the teacher is a major obstacle. In math, the instructors do not grasp the need of students to understand terminology.*
>
> *There is much confusion between reading and English. Reading is a process. It should not be taught as a "subject." Under certain conditions students may do well in English but not be "good readers" the way we expect our scholars to be.*
>
> *Treating reading as a subject has caused instructors to neglect responsibility for teaching students to read subject matter particularly appropriate to special areas of knowledge. Every teacher must be a teacher of reading in his domain of scholarship!*

A Pennsylvania science teacher we watched was showing a film strip on "freezing and boiling." He interrupted to point out one caption, saying, "Now that's a terrible sentence! There has to be a better way of expressing that point." How he added his testimony to the need for every teacher teaching reading and writing is told in the VORTEX case study (p 10:9).

Across our eleven sites we found widespread support for teaching reading, the "most basic of the basics," as one teacher called it. Science teachers handled this responsibility in many different ways, of course. There were pressures to cover their own syllabus or list of objectives, so no teacher felt entirely comfortable departing from the lesson to teach reading. But the conviction that learning is dependent on reading skill was strong, and most teachers we talked to wanted to help youngsters to increase their reading comprehension.

A Vignette on Basics. After visiting several of our sites CSSE co-director Jack Easley wrote the following vignettes to illustrate the "crunch" that nourishes the feelings that we have to re-emphasize the basics,--but hopefully in a way to make a difference.

> As Mr. Snow, an experienced life science teacher at Maas Junior High School, put it, "These kids can't read, and their arithmetic is really weak." He was not particularly relieved by the fact that the language and mathematical achievement scores of entering 7th graders are quite uniformly two grade levels above national norms.
>
> What bothers him is that they can't read a textbook and understand it. They can't follow directions for experiments. And working with numbers really bothers them.

In this classroom I observed students doing experiments which, he explained to me, enabled them to earn 10 to 15 points each if satisfactorily written up. Ninety points resulted in an A on the lab work for the unit. His grade book was open (and so marked) and students came up to see how many points they had earned.

A group of three girls (one of them the only black in the class) had written "CONVECTION CURRENTS" in the dittoed blank for the title of their experiment. Their books were open to a page which showed a small picture of the apparatus with arrows showing the water moving in the beaker in a circle. When I asked them what "convection currents" meant, one of them skimmed the paragraph above the picture and found the sentence which said that they "carried heat from one place to another." When I asked if that was a definition, another looked in the glossary of the book and came up with a more elaborate and technical definition.

Mr. Snow approached them and commented that the bunsen burner was supposed to be under one edge of the beaker. "Which edge is it under?" He asked. Viewing it from different angles, the girls couldn't agree, but they didn't move it either--perhaps not wanting to admit it was centered.

Mr. Snow said, "If you were just starting, I'd have you put the beaker much lower, just over the flame instead of way up there where you have it." "Does it have to boil?" they asked. "Oh, no," he said, "you can put the ink in any time." (There were lots of bubbles all over the sides of the beaker.) The girls finally agreed it was time to drop in the ink. The water instantly became dark blue.

"What's supposed to happen?" A girl at the next station said, "The ink is supposed to go up and down." All wrote in the Results space that the ink went up and down. When I mention the bubbles, as it was now boiling, one wrote that there were bubbles. Two admitted they didn't see the ink move, but after the write-up and disassembly of the apparatus I asked if they wanted to try it again. They all said they did not.

They handed in their reports. Other students seemed to be doing little better. It was easy to agree with Mr. Snow that they did not understand how to do experiments and could not read or follow directions. Or drawings either.

. . .

Fred leads the Wildwood project for the sixth grade at Hilltop school. He shares the classroom teaching with another teacher. As he talked about planning for the week-long outing coming up, he mentioned that many students could get the right answer to questions about how many of this or that supply they would need, but couldn't do it systematically by arithmetic. "Those who were best in classroom arithmetic," he said, "often couldn't figure out practical quantities for a real project.

Later, I visited his arithmetic class and found students working on logs of different problems (self-paced). Many had their hands up and I accepted his invitation to try to help. The students did not seem to be happy, but they were not really "goofing off" very much.

I wandered from one raised hand to another, sometimes being refused ("I have to ask the teacher this one."). One boy invited me to help him, then a girl at the same table. Finally I was busy, busy, trying to grasp the word problems, work them myself mentally, and understand the work of the students.

A girl solved an astronomical problem after discussing it with me. I couldn't follow how she did it. For a long time she was stuck, then suddenly she was finished and on to the next problem. I wanted her to show me her work, but she just had a scribbly page of scratch paper, with multiplications and divisions written one on top of another.

Mr. Murphy, the principal, in response to my summary of the outdoor project planning difficulties, described a mini-class he was running. It involved setting up and manufacturing hanging planters made of string and wood. He said he was going to let the kids do everything, including buying the supplies. He said he hoped they would have to borrow money and pay interest on it.

He said that when they came across a practical arithmetic problem he just let them struggle with it. It might take them two days. They eventually got it figured out to their satisfaction and his. I expressed interest in the magnitude of the problem. He admitted he couldn't figure how he could reorganize the whole curriculum so the kids would be able to make the connection between school arithmetic, where the problems were already formulated, and useful arithmetic where you had to figure out what the problem was, what to do, and how to write it down.

He admitted that, the way teachers did it in the classroom, (the way I did it in Fred's room), the kids would forget what they had been shown in a week. Such teaching had no utility, he felt.

But he had contemptuous words for the junior and senior high teachers who were demanding more math and reading skills than they find already in their students. He grabbed his test score printouts to prove to me that these kids were really doing far better than any high school teacher had a right to expect.

. . .

Jake Berlyn, the recently-appointed principal of Cody Elementary School, confirmed what I had observed, that the cadet-teacher in upper grade mathematics was a very competent person and the two aides were quite experienced.

For the second time in two weeks I had the opportunity to help out as a teacher's aide, this time in place of a paid aide who was absent. It was in the "best" fifth grade class. We three adults sat at tables scattered throughout the math class area. The sounds of other classes working in full view but a dozen yards away in several directions did not disturb us.

Soon there were three students cued up behind my chair awaiting my help. I was working with Al, an oriental boy who did beautiful long division, with decimals, but couldn't figure out in word problems what to divide into what.

One group of problems involved a table of the amounts of thiamin per 10 grams of different foods. The question was: How much thiamin was there in one gram of each? Once we had figured out one case, he hastily wrote out the answer for the others.

The next problem concerned a boy who went to the store to buy hamburger. How much could he buy with the money he had, given the price per pound? Al was lost. I posed a simpler problem. The boy had $2.00 and the price per pound was $4.00. Al came back right away with "8 ounces." After he converted it to pounds, which he could obtain that answer by division (avoiding the familiar question, "How did you get that answer?" He wrote: $\begin{array}{r} .5 \\ 2\overline{)\;4} \end{array}$ I asked him to check it to see if it was right. It wasn't. So I asked him to try again. He couldn't think of anything else to do. When I suggested he interchange the 2 and the 4, he was really surprised to discover that it worked.

Jake Berlyn agreed with me that there was insufficient time in the math classes for three experienced adults to help 20 children adequately so they would understand the math they were expected to do.

The student teacher pointed out to me the individual Stanford Achievement scores for each pupil. They were almost all two grade levels above present grade. We looked over the individual test items, even the "application items", and decided that many of the "distractors" were so far-out that kids could get a good score based on intuitive knowledge, without being able to understand how to work the problem.

Berlyn agreed that if math were taught with one teacher per pupil there might be reason to hope. We did not bother to go over the administrative and budgetary reasons that precluded teaching one-on-one. It was, he agreed, an indication of the magnitude of the problem.

Reading was a similarly acute problem, even though no one in the district was reading below grade level on national norms. Those kids ran into a big reading problem when they went to the junior high, a school where, Mr. Snow admitted, the 7th grade life science text had a 9th grade reading level.

Nelson Capretz, principal at Maas Junior High School,. . . was visibly upset at the above report. He reminded me that there were no illiterates in his school.

This vignette, perplexing and distressing, originated in a cluster of "advantaged" schools, ones with hard-working teachers; bright, dedicated administrators; reasonably cooperative students; and reasonably generous taxpayers. The problems of reading laboratory-directions and working word-problems are easily recognized by those who attended American schools before World War II and after. The children were not learning what we thought was a bare minimum, and we do not have any prospective changes--with or without a reasonable price tag--that would have a reasonable chance of success.

It would be comforting to be able to point to empirical justification for the new American reliance on the "basics." If we could only point to circumstances where a heavy emphasis on reading and arithmetic had in fact overcome the malaise of poor achievement, had stiffened the backbone of the students, and made the quest for literacy a thing of the past. We cannot point even to instances where that has started to happen.

MOLECULARIZATION AND SEQUENCING

Over the past twenty-five years school curriculum has been subjected to review and reconstruction. Particularly noteworthy has been the work of such researchers as B. F. Skinner and Robert Gagné. Theirs has been a rebuilding along task analytic, characterized by such admonishments as: "define the behaviors to be taught; identify the component parts; and teach the components in a sequence which has been empirically validated."

Such an analytic approach has historical roots in the Socratic dialogue and the Armbruster school. It is the pedagogical rationale for the IPI instructional system and for Englemann-Becker DISTAR materials. The task analytic approach is now becoming known among technologists as the "direct instruction" approach. It is highly visible today because it is an obviously good way to combine educational technology and an emphasis on the basics.

Analysis of Objectives. When we discussed the needs of the science curriculum with a science curriculum coordinator at the URBANVILLE site, she told us that for a long time they had resisted specifying the objectives of their program, fearing that it might dilute the subject matter or diminish the effectiveness of creative teachers--but they found for several years running that the Board of Education would only support those curricula that were so specified. They borrowed the massive catalogue of objectives produced by the Portland, Oregon school system and were hoping to build back the place of science in the curriculum. She was not at all unhappy with the new way of presenting their goals--just that it had taken so long to get it going.

We found that the task analytic approach supported media-oriented instructional programs, particularly those that were laboratory based. The Math Lab at VORTEX (p 10:8) was an excellent example. Those programs and spaces seemed to work exceptionally well, even when they became isolated enclaves, as long as enthusiastic teachers ran them. When those teachers leave, the programs are not easily picked up by other teachers--reminding Gordon Hoke, our VORTEX observer, of the fate of the Language Labs spawned by NDEA legislation (p 10:13).

The analysis aspect is always stronger than the synthesis, it seems, Thus the components were often taught rigorously and strenuously, as they were at BRT and FALL RIVER. The process of combining the components into complex responses for problem solving in naturalistic situations was de-emphasized, or even omitted, To most observers the curriculum had a molecular rather than wholistic appearance--which most perhaps considered an asset. The students impressed them by doing well on the criterion-referenced tests developed for the particular instructional sequence. Gains on more general tasks were seldom documented, and usually controversially interpreted. (See, for example, the difference in two interpretations of Follow-Through planned variation studies.*)

Sequencing. It is argued by the advocates of the basics and by the task analysts that one or a few sequences of instructional materials will be markedly superior in long term results. This will be discussed at greater length in Chapter 16. There were few teachers who argued for sequences of experiences extending up and down the grades, requiring simple exposures to complex phenomena in earlier years and complex involvement later. But most teachers agreed with a junior high principal in VORTEX (p 10:10):

> *Teachers are very uncomfortable with science. You really can't blame them. Personally I think instruction in science should be left to the upper grades. About all you can ask for is solid preparation in reading, especially comprehension, and mathematics when they reach you in junior high.*

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*Abt Associates, Inc., Education as Experimentation: A Planned Variation Model, Volumes IV A-D, Cambridge, Mass., April 15, 1977; and Ernest R. House, Gene V. Glass, Leslie D. McLean and Decker F. Walker, "No Simple Answer: Critique of the 'Follow Through' Evaluation," Harvard Educational Review, in press.

SCENARIO U

The influence of the "back to basics" movement on the K-12 curriculum was apparent in all our eleven sites. We prepared the following scenario to explore the issues discussed in this chapter in communities of our national sample. We presented the following scenario to high school social studies curriculum supervisors, high school mathematics teachers, and elementary school principals.

Scenario U

> Please consider this dialogue between two teachers, Maria and Jim, at a curriculum workshop:
>
> Maria: It's a lot of work, but I'm glad we are specifying just what our curriculum is. The more specific we are the better. It should help us concentrate on teaching the basic skills.
>
> Jim: But are we really describing the old curriculum or creating a new one? With the new mastery requirements will we have time to do enrichment projects and science explorations?
>
> Maria: We've spent too much class time on field trips and science fairs. We must set our priorities and spend the time where it should be spent: on reading, writing and arithmetic. Knowing what we need to teach will help us use tests to make sure we did it. We will eliminate the irrelevant topics and unrealistic goals.
>
> Jim: I'm not that optimistic. Three summers ago I revised a course using behavioral objectives. But in the all I felt tied down to them. They seemed too narrow, too simplistic. So I stopped bothering with them.
>
> Maria: Well, we are not writing behavior objectives. We are dividing the curriculum into mini-units and constructing mini-tests. Next year we will be able to show exactly what we have covered and what each student has learned. There is nothing narrow about this; if we want students to know complex relationships we just say so.
>
> Jim: I wish you luck. Dan Thorpe told me that in the competency-based math at his school, the tests do not accurately represent what the students know. No matter what competencies they would specify, they always ended up teaching and testing for the simpler things, leaving out lots of complex things. It bothers me.
>
> Maria: I'm not worried if the tests do not reflect the complexity of knowledge. Our job is to make sure that every boy and girl has the minimum competencies to continue to the next grade or graduate. They need to know the basics in order to get along in today's world.

Scenario U continued

We had the following responses to this scenario:

Group	Original sample size	Number of responses
Math teachers, grades 10-12	150	94
Social studies supervisors, grades 7-12	201	153
Principles, grades K-6	94	59

All percentages given were weighted according to the RTI sampling plan. See Chapter 18.

1. Are your feelings more like those of Maria or Jim?

	Maria	Jim	Neither	A little of both	Total Responding
Math Teachers	48%	10%	8%	34%	93 of 150
Social Studies Supervisors	37%	4%	14%	45%	151 of 201
Elementary Principals	30%	10%	9%	46%	58 of 94

2. Is the issue "Back to the Basics" important in your community?

92 of 150 Math Teachers	150 of 201 Social Studies Supervisors	57 of 94 Elementary Principals	
63%	63%	72%	___Yes, an important issue
28%	15%	3%	___No, but it should be
0%	1%	0%	___It was, but is no longer
9%	21%	23%	___No, not an important issue

3. What is your own feeling about increasing emphasis on teaching basic skills and knowledge?

We found our respondents split between increasing emphasis on the "basics" and stressing the need for balance between the basics and other skills and curriculum. Some of our respondents made comments as follows:

A math teacher in Worthington, Ohio: Necessary but not sufficient.

An elementary principal in Fairdale, Kentucky: Excellent, glad to see the pendulum swing back!

Scenario U continued

An elementary principal in Jefferson Heights, Maryland: I am concerned that the emphasis is becoming over-emphasis.

A math teacher in Broadmoor, Colorado: Basic skills must be mastered but not for the fact itself. . . rather to be able to project and use this knowledge to new situations: i.e., the idea of total education is to be able to GENERALIZE on the basis of knowledge.

A high school social studies supervisor in Brockton, Massachusetts: I'm all for it but not to the exclusion of everything else.

A high school social studies supervisor in Liberal, Kansas: Teaching only the minimum competencies will develop only a minimally competent student. The nation has enough of those now. Minimum skills are, however, very important.

4. Maria is pleased to be dividing the course content into small units and to be specifying competencies in each. Which of the following results do you think will be accomplished more effectively by this approach? (Check as many as you wish.)

94 of 150 Math Teachers	153 of 201 Social Studies Supervisors	59 of 94 Elementary Principals	
80%	67%	86%	___setting of priorities and allocating time for instruction
57%	45%	15%	___removing unimportant matters from the curriculum
40%	41%	53%	___raising or maintaining high standards of achievement
5%	29%	10%	___giving teachers more flexibility and freedom
23%	41%	31%	___making courses more relevant to the pupil's experience
7%	12%	1%	___other (Please specify):

5. Some people urge a big push to teach reading skills and math facts alone at first. Other people say you need to teach lots of basic information while teaching the skills. Others say "teach analysis and even interpretation at the same time." What do you say?

93 of 150 Math Teachers	146 of 201 Social Studies Supervisors	58 of 94 Elementary Principals	
57%	26%	36%	___I say "Teach the basic reading and math at first, the other things later."
17%	14%	15%	___I say "Teach basic skills and lots of content first, leave analysis for later."
20%	38%	45%	___I say "Teach all those together, all the time, in every grade.
6%	22%	5%	___Other (Please specify):

6. Some people think that scientific knowledge is "basic." Why are reading, writing, and arithmetic usually mentioned as "the basics" in elementary education and not science?

91 of 150 Math Teachers	147 of 201 Social Studies Supervisors	58 of 94 Elementary Principals	
0%	0%	1%	___Only a few people really need scientific knowledge
71%	51%	60%	___Science is basic but you have to teach the 3 R's first
1%	7%	0%	___Science can better be learned outside the elementary school
4%	16%	18%	___People who stress the 3 R's do not understand today's needs for education
24%	26%	22%	___Other (Please specify):

Out-Of-School Learning

There are at least as many opportunities for youngsters to learn science outside the school as in. This CSSE project did not directly consider the present status of out-of-school learning opportunities, but our field observers could not help but encounter them as they talked to teachers and students. We found it useful to distinguish between those opportunities chiefly arranged by people within the schools and those arranged by others. This of course is an important practical distinction for the National Science Foundation because extending science education offerings not arranged by the school calls for commerce with a new array of institutions, e.g., museums, television studios, public park programs and youth organizations such as the Future Farmers of America and Young Women's Christian Association.

Out-of-school programs arranged chiefly by school people included outdoor education, trips to museums, assignments to see movies and television programs, use of public libraries, and field trips. We were surprised to find relatively small use of out-of-school activities that required taking the class as a whole outside the school. In Columbus, Ohio, even during a period of special need, when honorifics were extended to field trips, observers Jim Sanders and Dan Stufflebeam found their use to be small. Primarily because they found it extremely difficult to get volunteer adult chaperones, teachers in ARCHIPOLIS had cut their trips to museums to about once per year.[*]

But we found some outstanding examples of school science outings, there at ARCHIPOLIS and elsewhere. An excellent use of out-of-school opportunities to learn science had occurred in the ALTE schools. From kindergarten to 12th grade the children participated in a year-round outdoor education program: arboretum, camp, ornithology trips, climbing, exploring. At the Nature Center observer Lou Smith saw (p 3:52):

> the teacher and a half dozen of his kids (bring in) a whole set of equipment and materials and set up shop in one of the outbuildings. . .empty aquariums, work tools, a library. It was an incredible picture. . . And everyone seemed to be working in, working on, and working about with the materials. . . .

The success of the program was partially attributable to support in the district office, at each school, and in the homes of many parents. Most of those homes, it is remembered, are fully able to afford libraries, camps, and trips of their own.

But those examples were the exception. As we made our visits to the eleven sites we heard perhaps the full array of reasons why it was logistically impossible and pedagogically inefficient to use out-of-school resources. We asked about this condition in our national survey, setting up a common claim to measure the support for it (passing up the opportunity to establish alternative claims or the reasons for or against the claim). The claim in this instance was:

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[*] We noted that insurance costs and liability, transportation costs, availability and qualification of chaperones, greater demand on school buses, etc. have reduced the use of field trips. These restrictive forces are at work of course, in many ways in our society, not just in education. (The NSF could consider unusual ways of sustaining field opportunities, such as by underwriting insurance.)

> Teachers seldom use TV, museums, and community resources to supplement teaching.

Percent of people agreeing with the claim:

	Large city >100,000	Large Suburban	Non-Metro <100,000	TOTAL	Number Responding
___Teachers	36%	39%	24%	26%	177
___Curric Supr's	47%	50%	31%	34%	238
___Administrators	29%	1%	32%	19%	77
___Students †	58%	74%	69%	67%	248
___Parents †	50%	44%	49%	44%	138

(Readers will note that the claim is worded negatively. Apparent discrepancies may be due to the limited numbers of respondents in each category--e.g., "Administrators.")

	West	Midwest	South	Northeast
___Teachers	25%	42%	12%	19%
___Curric Supr's	19%	33%	47%	30%
___Administrators	1%	12%	15%	87%
___Students †	55%	66%	66%	77%
___Parents †	33%	45%	48%	43%

Percents are based on the group responding to the item.
Standard errors are not available for these weighted percents.

†Unweighted percents are used for students and parents.

One Colorado elementary school principal said:

> *I think at times we have had a little smattering of everything and not much of anything. And yet, I do not think that our kids are coming out of it illiterate. I think what they're learning is being learned outside the school.*

MUSEUMS

One may recall the words of Loren Eiseley,* the late paleontologist:

> *The boy under the street light may become fascinated by night-flying moths or the delinquent whisperings of companions. Or he may lie awake in the moonlight of his room, quaking with the insecurity of a divided household and the terrors of approaching adulthood. He may quietly continue some lost part of childhood by playing gentle and abstract games with toys he would not dare to introduce among his raucous companions of the street. He wanders forlornly through a museum and is impressed by a kindly scientist engrossed in studying some huge bones. . . .*
>
> *There are subjects in which I have remained dwarfed all of my adult life because of the ill-considered blow of someone nursing pent-up agressions, or because of words more violent in their end effects than blows. There are other subjects for which I have more than ordinary affection because they are associated in my mind with kindly and understanding men or women--sculptors who left even upon such impliant clay as mine the delicate chiseling of refined genius, who gave unwittingly something of their final character to most unpromising material. Sculptors reaching blindly forward into time, they struck out their creation, scarce living to view the result.*

The education community sometimes loses sight of the sources of enlightenment and compulsion in our lives. The commitment of a youngster to become a scientist or a responsible citizen is less a matter of skill or reason, more a matter of conviction, aided by kindness and understanding shown by teachers, shown in chance encounters, such as young Loren's with a kindly scientist in Morrill Hall on the University of Nebraska campus.

Well, a museum is one of the last places to look for a kindly and understanding display of stuffed peacocks--at least so many people feel. The Education Curator at the museum is almost the least significant of functionaries. If the holdings won't be damaged the public is welcome and public school groups will be tolerated. There is seldom energy and patience to put up with a noisy generation of young visitors. A staff member rarely breaks out from protectiveness and indignation and waits upon the unending stream of children. Such a teacher-curator, however, there was in the Science Museum in Boston. Rob Walker reported (p 11:30):

> A large bearded man wearing glasses is sitting up on a dais in a corner of the museum. Next to him a column emits lightning sparks. As he talks the fluorescent light tube he is holding over his shoulder glows, even though it is not connected to anything. . . . goes on to explain the apparatus doesn't

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*Loren Eiseley, "The Mind as Nature" (New York: Harper & Row, 1962) reprinted in The Night Country, (New York: Chas. Scribner's Sons, 1971), p 201.

> have much practical use. . . a good bit of the time he tells Tesla. . . . Again there is a feeling here someone is talking about something he really cares about. . .

But again, the contribution of museums to science education is seldom person to person. More common are the displays and the models (e.g., water works, great grandmother's things), even ones you can play with, such as the teletype terminals at Berkeley's Lawrence Hall of Science. At a museum computer terminal in Boston (p 11:30):

> a boy sits filling up the display with digits and then clearing them. After repeated attempts he tries the other keys, add and subtract for example, and seems puzzled when nothing happens. The other functions (like squares) are more rewarding. When you press those, the numbers move.

(Site visitor Hassler Whitney noted, "none was in use when I was there.")

How is the child's mind stretched in new ways toward the systems of science? How are aspirations affected by the visit? Museum program evaluations cannot tell us yet, perhaps never will. These sharings of inexplicable experience (but a sample here of many there in the GREATER BOSTON case study) were summed up in the words of a young staff member named Daniel (p 11:31):

> *I think we in America expect too much from our schools. The way I see it, there are two distinct systems involved in education. One is the learning of ways of conceptualising and categorising: what Bruner calls, "learning how to learn." The other is the development of personal metaphors for understanding the world.*
>
> *I don't think schools, or perhaps any other institution, can cope with the demands of both systems. Schools may be very good places for learning symbol-systems, for learning how to communicate, and for learning how to survive in our kind of society. They just seem to be rather poor places in which to learn science. The two different systems just are not compatible with each other. Learning in the sense of realizing personal metaphors for understanding the world is, I think, best accomplished in more intimate social contexts than you find in most schools.*

The science museum can be such a context.

EDUCATIONAL TELEVISION

Reflecting upon our encounters in the few places in our eleven districts where there was a strong effort to use television for science education, we were persuaded that programming done by the schools or for the schools has little promise, but school use of other educational or commercial television and individual student use of television have considerable promise.

The Schools Without Schools emergency program in Columbus, Ohio, gave us a brief look at school-based television under poor logistical but highly favorable socio-political conditions (p 8:7):

> While. . . TV was the most visible part of the program and the one that received the most national acclaim, it was also one of the weakest instructional parts of the Schools Without Schools program, This was not because the programming and presentations were poor, but because there was little motivation to use them or opportunity to relate them to the programming and teaching being done by individual teachers. There was little advance involvement of regular teachers in curricular decisions; and advance information about what would be on the media--which was needed by the teachers in order to plan for and use this service--was missing.

The inability in Columbus to organize an elaborate use of television instantaneously should not be much of an indicator of the potential for school-organized television programming. However, the almost complete lack of enthusiasm for this medium and the organizational obstacles it faced (especially at the secondary level) should indicate some of the difficulty that programming would face.

Successful coordination of school use of public broadcasting services was demonstrated in our Pennsylvania site. Observer Gordon Hoke wrote (p 10:14):

> VORTEX schools are tied to a PBS station, . . . school buildings--and much of the city--are also wired for cable-tv. Students engage in production and performance activities beginning with the primary grades, frequently preparing video-tapes for local use. ETV is part of the Audio-Visual department, and its director, who is an outspoken advocate of the medium, views instructional television as having a major influence on science education in the lower grades. . .

The use of students in programming is an important feature--to be found in other systems such as St. Paul, Minnesota. The purposes are clearly different from those where students are seen as audience only. Except for the advantage of timeliness with live broadcasting, most audio-visual educational presentations can be handled better in the classroom via motion picture projection than by television.

Very few teachers or students mentioned the use of commercial or educational television for homework assignments. Just once we observed a teacher, this one in a Life Science class in ARCHIPOLIS, doing so. On the board she wrote (p 9:9):

> Homework: Watch, 7:30 tonight, "Wild Kingdom," Channel 10
> 1. Name the population
> 2. Name the habitat
> 3. Describe the niche

It was apparent that students there and elsewhere were familiar with Jacques Cousteau, Mr. Rogers and the cookie monster--and that teachers sometimes encouraged children to watch such shows, but little more formal use was found. Teachers were not passing credit to Sesame Street for getting children more ready for arithmetic instruction than they would have been otherwise. But these comments were perhaps giving too much credit to planned and coordinated instruction. One teacher said in a response to a CSSE survey question:

> *I believe that television has been education's worst enemy by making students passive learners. Since it is highly unlikely most families will dispense with their TV sets I would urge that the NSF and other education offices pressure the industry to present more scientific and historical features during prime time on commercial stations. PBS broadcasts are wonderful but many students do not watch them and in many homes the reception is not as good as the three major networks.*

As with Loren Eiseley, much of the initiative to learning occurs without planning or purpose. The programming of the commercial networks is well known to the youngsters--it is almost certain that they are stimulated in both good and bad ways. Recently a Yankelovich survey showed three out of four parents agreeing that their children had learned good things from television.*

According to Newton and Nell Minow** "the last group to understand how to use television has been professional educators." They concluded a review of children's television with:

> *As new techniques of production evolve, teachers must learn how to use them. For the most part, public television has advanced in America without the support of intellectuals and academics, who were too busy looking down their noses at television as an inferior medium for the masses. If there were a limited number of printing presses in this country, intellectuals and academics would have vociferously insisted that at least one or two of them be set aside for noncommercial use for the advancement of knowledge and culture. But because the medium involves a technology other than familiar print, public television has had to win public support without the aid or support of the intellectual community.*

One of our site visitors from England, Frances Stevens, commented on her first impression of the color and flair and topicality of American textbooks. The television networks are even more colorful, attention gathering, and (for all their narrowness and over-simplification) broader and more complex in topicality than the American textbook. There are further potentials for science education there.

NONSCHOOL EDUCATIONAL ORGANIZATIONS

Young people and older people alike join organizations for combinations of social pleasure, competition and educational advancement. Among the best known are the YMCA and YWCA, the Boy Scouts and Campfire Girls, 4-H, and Boys Clubs. As social changes have occurred in our society, these organizations have undergone change too, and some have reorganized. The process is no easier for them than it is for the schools. They look for new members, new appeal, and they yearn for the stability of years past. The following excerpt from an evaluation report* of the Shemamo (Illinois) Girl Scout Council is illustrative:

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*General Mills American Family Report, "Raising Children in a Changing Society," Intellect 106 (November 1977): 177-179.

**Newton N. Minow and Nell Minow, "What Are We Learning from Television?" Change 8 (October 1976): 48-49.

> *Troops are organized around schools, yet schools are the least stable of community organizations (related to busing, family mobility, etc.).*

Many of their educational pursuits have a science orientation: wilderness ecology; ethnic heritage; physiological development and fitness; livestock breeding; etc. A drawback they share with school adult education and university extension services is that the instructors are often less able than the leading students. These students lack an instructional support system in their specializations.

We have noted individual young people, sometimes working with a parent or craftsman, pursuing their study of such matters as the verticalization of pork production and merchandising, repair of high fidelity audio systems, using of polling techniques for newspapers and advocacy groups. To actually give them instruction in relevant sciences might be very costly but to facilitate their personal contacts and opportunities for self-study appears to be a new possibility for science educators. But even to provide them (perhaps through vocational education instructors) with better information on available institutes and informal networks of scientists and technicians would be of value.

Opportunity for supporting** science learning for groups may be clarified somewhat by reporting on one of the popular youth organizations:

> Four-H is praised for out-of-school opportunities for rural youth. Although in recent years 4-H has been criticized for failing to reach minority youth, particularly in the cities, a charge the organization is trying to counter with a variety of new activities, decades of favorable publicity and federal funding have made 4-H a strong organization.

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*Personal communication to CIRCE from the Director, Shemamo Girl Scout Council, Decatur, Illinois, received December 5, 1977.

**NSF support for such independent enterprises as 4-H might require a de-emphasis on the questions commonly asked by the Contracts Office or the Office of Management and Budget, "Can young people get this opportunity to learn somewhere else?" The question of redundancy may not be as important as the question of effectiveness, such as "Are young people actually utilizing this opportunity to learn science?" Redundancy remains a concern in that students can get saturated with certain teachings, such as about ecology and energy today, but those problems too may be better handled by reviewing good data on the quality of opportunity provided by the "educators" and utilized by the "learners."

"Learning by Doing" captions the masthead of 4-H clubs. Adult volunteer leaders work with youth, ages 8-19, in attempts to give the caption operational meaning. Cooperative Extension centers, normally functioning on a countywide basis, lend technical assistance to the "Doing." (The values of experiential learning were hailed in the 74th Yearbook of the National Society for the Study of Education where the author Richard Graham,* warned that many American youth could not complete the adolescent transition without a reform of education combined with new arrangements linking public schools to other institutions).

Four-H is launching a series of endeavors known as "school enrichment" programs which are designed to bring the agency into closer liaison with local schools. The initiative is certain to "test the waters" of institutional coordination and cooperation, a challenge that frustrated such forerunners as Project Follow-Through, NDEA Title III, ESEA, and other offspring of Great Society thinking. Science Education seems ideally suited to accommodate these 4-H ventures whether they are food and nutrition programs directed at inner-city living or more traditional issues of concern to farm youth.

But there are problems. In Chapter 8 we referred to the absence of a profound sense of relationship characterizing many informal learning opportunities and to the difficulties of sharing responsibility for community education.** The lack of quality scholarship in science-based programs available through the auspices of land grant universities, their extension services, and affiliated 4-H clubs was stressed in an analysis prepared by Andre and Jean Mayer.*** Citing the need for embracing mathematics, astronomy, and physics if agriculture is to honor demands inherent in its future position of eminence, they declared:

> *More than ever, the science of agriculture stands out at the center of a broader system integrating human society and its physical environment.*

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*Richard Graham, "Youth and Experiential Learning," 74th Yearbook of the National Society for the Study of Education, Part I, Robert J. Havighurst and Philip H. Dreyer, eds. (Chicago: University of Chicago Press, 1975), pp. 161-192.

**A recent critique of career education programs warned that "...it might make sense to recognize the limitations of informal alternatives in this post-industrial world." Eleanor F. McGowan and David K. Cohen, "Career Education--Reforming School Through Work," The Public Interest, 46 (Winter 1976): 46.

***"Agriculture, the Island Empire," Daedalus-Science and Its Public: The Changing Relationships 103 (Summer 1974): 83-96.

Unfortunately they feel the Campus-Extension network is too frequently offering simple answers to complex problems.* Submitting that agriculture has become an isolated entity on campuses by developing "its own scientific organizations, its own professional trade and social organizations," and is perceived by farmers as a place where experts treat "practical problems and give immediate answers," the Mayers viewed the end results with serious misgivings: "In the 4-H clubs, the colleges, the experiment stations, and the extension programs, people came in contact with a science that [was] benevolent, useful--and limited." In recent studies of 4-H programs, CSSE personnel encountered another dimension of this critique.

For example, numerous rural households have already incorporated new forms of communications technology into their daily lives. Many families were using two-way radio as a type of telephone linking the house to the fields. Both volunteer leaders and members of their clubs were often engaging in more imaginative uses of media than those allegedly responsible for "teaching" them.

The technological sophistication noted above was crucial to success in certain domains of agricultural production. According to Nathan Rosenberg, Stanford economist:**

> *It is clear--and important--that the kinds of skills generated by agriculture depend very much upon the kind of agriculture one has in mind. . . . The pattern of agricultural activity in the American midwest was of such a nature that it developed a high degree of commercial and technical sophistication on the part of the labor inputs. . . . Midwestern farming has been, to a considerable extent, an example of a complex system of vertical integration on the part of the individual producing unit--the individual farm typically produces the food-cereal products which constitute the basic food input of its livestock population.*
>
> *The midwestern farm is often a fairly elaborate enterprise where the decision-maker must be close to the detailed day to day operations of the farm and which require a familiarity with market phenomena and a wide range of technical skills. Midwestern farming has therefore produced effective managers and people well-versed in mechanical skills who have successfully transferred these skills to other sectors of the economy during the prolonged secular decline of the agricultural sector in the American economy.*

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*The Mayers' criticism is echoed in two recent publications: (1) R. O. Coppedge and Carlton G. Davis, eds., Rural Poverty and the Policy Crisis. (Ames, Iowa: Iowa State University Press, 1977); (2) Wendell Berry, The Unsettling of America: Culture and Agriculture (San Francisco: Sierra Club Books, 1977).

**Nathan Rosenberg, Perspectives on Technology (London: Cambridge University Press, 1976), pp 97-98.

His analysis is reflected in comments submitted sequentially by Archibald Haller and Arlen Gullickson, site visitors to one of the rural CSSE settings:

> School seems meaningless to a surprising number of the students I spoke with. And the outside world, except for their vacation spots, seems unreal and distasteful. What counts is farming, selling farm equipment, and keeping the farm operations running. The students' parents are not especially well educated, and they are doing well financially. The young people do not see much of an advantage to be gained by learning, including science. But "everybody" goes to school, even college, so each one thinks he has to, too. And they do.
>
> It is not at all evident how the cause of science teaching could be promoted in this sort of environment. The science teachers are good and well-funded, but learning apparently seems useless to the students. Perhaps they are learning enough science to be good consumers of it when and if they become farmers, or perhaps in other roles of life. But they certainly do not develop a serious interest in or commitment to science as a vocation.
>
> . . .
>
> I just read Dr. Haller's comment and agree on all but the close of his statement. Science teaching can be improved for agricultural areas, if teachers key on the local resources. I believe that the size of a school does not determine the quality of a program. Also, to me it's not important that the rural children don't grow up to be scientists. It is important that the rural children don't grow up to be scientists. It is important that they know and use science in farming and their daily lives. I think in general curricula are poorly structured for these areas. I suspect well written curricula with titles such as "Science for the Farmer" or "Science in the Rural Community" would do much to benefit science in these areas.

In some parts of the country 4-H perhaps could supply leverage for bringing schools and community agencies together in productive combinations of science education. In places where it has had no history, 4-H could not be expected to be of much aid.

The point here is not to identify an out-of-school organization for a science education alliance or to contend that agriculture is a primary entry for further study of science. The point is that improvement in school-based science education has not resulted from course renovation and teacher support alone. Further efforts outside the school may be more productive than in school. A strategy of using existing programming structures (such as 4-H has, as do public television and public parks programs and others) and finding personnel who are already strongly committed to science education (as museum staffer Daniel was) appear to have untapped potential for improving science education in America.

Instructional Materials

The teacher in most classrooms was in charge of the classroom, not just the presiding officer, but the head of family. And if the teacher was not, no one was, at least no education official was. The classroom belonged to the teacher, not to the building or the district. The teacher was not all-powerful, but without the teacher there was no power, no educational force. Of course there were exceptions, but in most places the teacher assumed the role of arbiter and authority.

CENTRALITY OF THE TEXTBOOK

But arbiter much more than authority when it came to the curriculum. The source of knowledge authority was not so much the teacher--it was the textbook. Teachers were prepared to intercede, to explain, but the direct confrontation with knowledge for most students was with printed information statements. Teachers did it differently from classroom to classroom, but regularly there was deference to the textbook, or lab manual, or encyclopedia, map or chart. Knowing was not so much a matter of experiencing, even vicariously (self-knowledge perhaps was not to be trusted), but of being familiar with certain information or knowing how to produce the answers to questions that would be asked.

> Eight fourth-graders were circled around the teacher for their social studies lesson. Miss Williams asked "Why is New York a world city? At the top of page 142, why is New York City a world city?" (No answer) "Terry?" Terry reads, "New York City is one of the great world cities," and looks questioningly. "No, look on into the paragraph. The headquarters of the United Nations is there and trade with all the countries."

At another site, CSSE visitor Frances Stevens said after observing a history class:

> . . .it was evident that the students were trained to seek answers to questions posed by the teacher, and that their concept of success was to find the right answer.

To be sure, we saw a number of efforts to get students to learn for themselves, to acquire, to discover, to rely on their observation and reasoning powers, but the preponderance of teaching was to import conclusions from a distant authority through the orderly presentation of the lesson materials. It was interesting to note that where teachers were asked how much they emphasized memorization they said that facts were important but that they taught interpretations too--(with emphasis on the factual content of the interpretation rather than on the importance of interpretation fitting with personal experiences and reasoning).

In PINE CITY the physiology class oriented itself to the key questions of the lesson--as stated in their textbooks (p 6:34):

> *"What are three characteristics of the nervous system?"*
> *"What's the difference between a threshhold and a sub-threshhold stimulus?"*
> *"What's the difference between the nervous system of the amoeba and the human?"*

During recitation the answers. . .

> come back in the stylish rhetoric of the textbook. Clearly the essence of the task has been to search the text for the sentence which contains the correct answer.

In BRT a fourth-grade teacher said (p 4:34):

> *In math we have new books in the Macmillan series and we're basically following the order of the book. We've come to multiplication now, but the book assumes a background of multiplication that this group doesn't have. So I've arranged for the students to learn at their own rate. I told them they must rote memorize because they can't do complex problems otherwise.*

But not always. In a WESTERN CITY physics class (p 7:24):

> . . . the class was performing a laboratory experiment. They were working with the ripple tanks studying wave reflections and refractions. . . . When quizzed about their reading assignments, they also appeared to be well informed about what they were doing and the theory behind their experiments.

In most classes we observed from third grade through twelfth grade the students had few materials to manipulate, many materials to read and write on. The teacher explained some points and added a touch of personal experience, but spent most of the time directing the attention of the students to the information contained in the readings.

AVAILABILITY OF MATERIALS

More than 500,000 non-print instructional materials and an additional 5,000 print were marketed for use in the K-12 curriculum in 1976.* Of the approximately 2,800 textbook titles marketed for use in science, mathematics, and social studies, a relatively small proportion of that total were in use in a majority of the nation's classrooms.

The ten most-used materials in mathematics in the U.S. at this time were clearly traditional programs, all quite similar to each other in terms of instructional design and (although it is less relevant in this discipline) social and personal value systems. They were also traditional in terms of the way they were developed. Of these ten most-used materials, six were marketed by the same publisher. Among the first thirty-two mathematics materials listed in the EPIE Report, only one program was the result of non-traditional development, from a federally-funded course development project. This material ranked 24th, being cited by less than 3% of the EPIE survey's respondents.

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*EPIE Institute, EPIE Report, No. 76, New York, 1977, p 1.

Science almost followed suit. Just as one company published six of the ten most-used mathematics materials, so one company published six of the thirteen most-used science materials. However, among the first ten cited materials, and listed fourth, was a Regional Laboratory produced program that was demonstrably innovative and quite different from the other generally traditional materials. Although most of the ten most-used social studies materials were fairly alike, there were some innovative materials too.

We did not do a similar census of instructional materials at our CSSE sites, but we reached a strong impression that the schools were sticking with popular texts and workbooks. As stated above we were even more impressed by the centrality of these materials in science, mathematics and social studies instruction in all grades.

In Science. Elementary science appeared to be a "sometimes thing" at best in the curricula we observed. In BRT an elementary teacher reported her class was behind in science, ". . . because I'm not as good in science as in social studies where I do lots of map work" (p 4:51). Another story came from URBANVILLE where a science coordinator said:

> *Even though state law says teach science as a lab science, with so little money you have to teach it from the textbook. At the elementary level many teachers cannot teach science and many do not try.*

One of the "first things to go" was elementary science according to the story in COLUMBUS, the district which attempted to offer "school without schools" during the 1976-77 winter energy crisis. And in VORTEX we found elementary science reported to be in trouble because the old books were replaced.

> *The old books included everything--the whole science program. But today I feel the people who write the science books have lost all contact with children. You have to sit down and either read them to the children or the teacher gets up and tells the children what was in the first three pages.*

This last point is a telling one for elementary and secondary school science, social studies and mathematics. Some teachers at all grades called for better instructional materials for learners with reading deficiencies. Field observer Jacquetta Hill-Burnett noted (p 9:23)

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*One of our site visitors, William Dunkum, citywide science supervisor at Arlington, Virginia, was of the opinion that "the Pathways books are notoriously corrupt in terms of subject accuracy. The questions asked are frequently unconnected with associated chapters." The Pathways books were the first commercial, widely available, low-reading level high school science books of the late 1960's. Millions were sold nationally. They greatly contrast with most of the books produced by course content improvement projects funded by NSF.

Another low-reading level textbook is Concepts and Challenges in Science, Book 1, produced by staff members of the New York City Schools. According to site visitor Fred Rodgers, who earlier reviewed the book, "the informal, pictorial content still is greatly dependent on reading skills with concepts presented as new words (almost as if it is a vocabulary-development lesson) and not developed as ideas that have general . . . application. . . ."

"it was a special emphasis on word labels, definition of word labels and reading that made the sciences as dependent on reading skill as were the humanities." She found that "books that used the written word and paper and pencil to simulate inquiry and discovery were well received by the children," adding that "the Pathways in Science series was a favorite with every child I talked to."* Across all our eleven sites there was occasional indication that although the current materials were seen as unusable and that better ones could accomplish their goals, teachers' faith in the capability of materials per se remained high.

One of our URBANVILLE site visit team members captured a common impression of elementary science teaching (p 5:28):

> The treatment of science on the K-6 level is really nothing more than show and tell. This school district has had monetary cutbacks which have shortened the school day. Most of this day is spent with reading, writing, spelling, and arithmetic. Although the students really enjoy science, it can only be fitted in two or three times a week. There is no money for prepackaged materials so the teacher's preparation time for science is greatly increased which correspondingly diminishes the variety of lessons available. The teachers endorse a sequenced approach to science similar to the math program.
>
> I believe that the above described program is presenting the absolute minimum (if that) amount of science that is acceptable. Aside from the obvious problems of time and money, I feel the whole effort is suffering from a lack of rationale. Why teach science to children? What should we expect a third grade child to know about science?

Student-created materials were rare indeed in science and math. Even science fairs were in distress. Students, teachers, and parents alike were increasingly resistant to supporting extra-curricular activities besides sports and the budget crunch had school boards frowning on proposals to institute new programs or even to maintain old ones. In a few settings we found elementary science kits in use. Scattered instances of teachers using ESS, SCIS and SAPA were noted. In one junior high setting (FALL RIVER) we found locally created science packets. Four teachers met weekly to plan, revise and rewrite topical units called TREKS which Mary Lee Smith, the observer, found to be attractive for the students (p 2:15). High school science instructional materials were in similar shape. Textbook selection committee members in BRT were discouraged.

> *The science texts we looked at were very discouraging reading-wise. Just because of the vocabulary, but I guess this is necessary.*
>
> *You need good science authors.*
>
> *I think teachers would be more interested (in teaching science) if they had those books available.*

Similar faith in the textbook, the right textbook "if only it could be found," was expressed in PINE CITY. There and in ARCHIPOLIS, the text in high school science was the answer place for the teacher's questions.

The power of the text to dictate expectations was manifest in the PINE CITY student who said, "I'm small town. The books are written on a real high level" (p 6:38). An echo was heard in RIVER ACRES where one informant said, "You see here in the South I do not think we can take a book written by an Easterner and make our people handle it in the eighth grade" (p 1:101).

In half the high schools laboratory science was reported to be nearly impossible to conduct because the labs were run down or ill-equipped; some without gas or water in PINE CITY, some waiting over a year for ordered chemicals in ARCHIPOLIS. A time-space crunch vitiated much of science laboratory work. In BRT and RIVER ACRES teachers described the nearly impossible task of "setting up and taking down" within the constraints of an instructional hour. The PINE CITY impoverishment was not unlike conditions observed by a site visitor in ARCHIPOLIS.

> In Room 21 a crowd of young men and women were examining blood samples under a microscope—many people to a microscope, long waits in between lots of kill-time talk. (Empty rooms nearby testify to a more affluent past, maybe 30 years earlier when middle class whites sent their sons and daughters to this elegant school.)

The ALTE story was the one we all wanted to hear. Science education, robust, in place, active, "hands on." Texts and homework were seen as positively imbedded in a broad, rich science program. Readers who seek to read about science instruction thought to be among the best we documented should turn to ALTE.

A principal failing of science instructional materials from junior high school on was their presumption of mathematical understandings and skills by the students. The picture in VORTEX was one of uniform difficulty in all three junior high science programs with the math requirements in the physical science textbooks. Indeed, we found that, "mathematics is dominating the junior high school science curriculum" (p 10:11). But some teachers wanted even more. In those respective case studies we quoted a FALL RIVER high school chemistry and a RIVER ACRES physics teacher who longed for texts to support more advanced work. BRT teachers held high regard for BSCS blue and and PSSC Physics for their very best students. Detractors could be found, such as the FALL RIVER science teacher who summed up PSSC for him by saying, "NSF backed a real loser with that one" (p 2:7). But an URBANVILLE teacher spoke for most of our science teachers saying:

> *The NSF did a great service with BSCS, IPS, PSSC, etc. The shortcomings could be avoided in future works. Most teachers used the materials as they were. Then they "modified" them to suit their needs. Then, as books became outdated, etc., the modification increased. As the books are a great investment, replacements are hard to get. New versions can't be purchased.*

Even the temporarily radical COLUMBUS "deschooled approach" to teaching science and mathematics produced no noticeable curricular residue. When the schools went back in session it meant back-to-the books in science instruction. Although elementary teachers there were occasionally innovative in their teaching of science, the big problem reported for the teaching of elementary science was the transportation of one's own materials or borrowing those in a host school. At the secondary level, teachers reported considerable pressure to cover the material normally expected, and the typical method of instruction those three weeks was one of "hand in the assigned homework and we'll discuss it." Laboratory exercises were reduced to near zero (p 8:11).

Reasons given varied but the two following were voiced frequently: (1) "Not enough time in one class period when you have to give assignments and collect papers": (2) "I don't want anyone coming from another school to start using MY laboratory and MY chemicals (or equipment) and I wouldn't go into another school and use another teacher's laboratory and use his chemicals (or equipment)." Communication and cooperation about equipment use needed to be encouraged and facilitated. One teacher felt that the administration should have mandated that each teacher mount a complete educational program. This might have included instruction, laboratory, help sessions, and evaluation plans. There was a recognized need for self-contained instructional units or packages. Such packages might include objectives, references, materials, worksheets, evaluation materials or activities.

In the Social Studies. What to do with the poor reader was the nut to be cracked in the social studies curriculum according to many teachers. "They can paint only so many murals," an elementary school principal quipped in RIVER ACRES. The importance of instructional materials was claimed by the senior high school social studies head in URBANVILLE.

> *"Our teachers do not need staff development. We need better materials, especially in U.S. History. . . . Curriculum reform has helped little; teachers face too many obstacles to change; ideas (are) good but nuts and bolts help is needed."*

Libraries and instructional materials or learning centers were found to range widely in their use. The ALTE high school library was described as "jammed" and its learning resource center "hummed" with student work. This in sharp contrast to the deadly quality of the junior high school libraries in RIVER ACRES or the playspace character of a BRT fourth-grade materials center. The mere provision of supplementary materials or presence of elegant technological apparatus guaranteed little. Note how even in ALTE "the road leads back home to the traditional worksheet" in this description by a site visitor.

> The key concepts in the school programming are individualized instruction, integrated subjects and electronic equipment such as head phones, tape recorders, TV, video taping equipment, and calculators. However, after observing in six classrooms in two schools for a total of about five hours it was noted that the majority of interactions of students, teachers and electronic equipment were around worksheets. Within this time period I attended two classes (fifth grade social studies and 4th grade science) which were planned as demonstrations for either visiting teachers or the principal. One had five minutes and the other 10 minutes with pupil/teacher discussion, utilizing the rest of the time for worksheets. These worksheets were to develop language arts skills while using the subject matter content of social studies and science.

In Mathematics. Mathematics teaching K-12 was almost exclusively focused on text materials. Manipulanda were used decreasingly up the grades and the texts were seen by many as too hard and confusing. VORTEX and RIVER ACRES teachers reported their belief in what good materials could do. Math lab teachers complained of seeing themselves as bookkeepers more than teachers, even while reporting success in their undertaking.

Individualization of mathematics instruction occurred to the extent that the same content was presented more slowly or rapidly as in WESTERN CITY, ALTE, RIVER ACRES. The outstanding example of apparently truly individualized mathematics materials may be found in the FALL RIVER report (p 2:18). Public controversy associated with one individualized instructional system (PLAN) was such that its educational merits probably were overshadowed. For a description of a different type of individualization and of a rare use of computer assisted instruction see the vignette of an elementary student doing a lesson on the University of Illinois PLATO computer system in the section on motivation in Chapter 15. Instructional television had sparse use due to the scheduling problems associated with the medium--particularly so at the junior and senior high school levels.

In VORTEX the lack of individual consideration in the "individualized" materials was revealed in this extract from a site-visitor's report.

> 1. Presently the top students are placed in Advanced Placement courses, the remaining students are somewhat haphazardly divided into classes of between 25 and 30 students. The lack of further grouping of students according to ability levels has created many difficulties; the better student becomes bored, turned off; the slower student becomes lost. Individualized attention is impossible because of class size. The problem becomes more complicated when one discovers that the same textbook is used for both the A.P. courses and the regular courses. There is little distinction of the degree of difficulty of these courses. The only distinction is the pace with which the material is covered.

Our study found but few traces of modern math. Some said it was dead. Some said it was stillborn; others that it had fatal genetic defects. It is probably wrong to say that it came and went. For most classrooms it probably never came. In URBANVILLE for example, conventional textbooks with 1960 copyrights were used in most classes (p 5:6). The sequence of instructional activity was seen to be the same in all classes. First there were the answers to yesterday's assignment followed by work at the chalkboard by the teacher or students of today's more difficult problems. New problems were then assigned from the text for the next day and the remainder of the period devoted to homework with the teacher moving as described in FALL RIVER (p 2:10).

In General. We did little to probe the procedures for changing and selecting course materials.* It seemed to teachers and administrators not an important topic. Some saw no leeway for changing, no money or no power--most felt that materials were not among the "big" problems.

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*Superintendents responding to our national survey reported that in 70% of the districts the school boards did not get more than minimally involved in the review and selection of science curricular materials.

The dependable packhorse of science teaching and learning was the material used to carry the instructional burden. It seemed to be doing the job most teachers, administrators, coaches, parents and students expected of it. The real struggles in the schools were elsewhere.

After all, instructional materials were budgetarily trivial. Far less than 2% of the average school district's budget was so spent. They were seen as dull stuff by most observers of education: who could create a poem, novel, or screenplay about the blossoming of a textbook?

But the recent EPIE survey revealed these monetarily trivial, topically dull things were crucial to science instructors in the U. S. Over 90% of the science teachers in a sample of about 12,000 teachers said their instructional materials were the heart of their teaching curriculum 90-95% of the time. Behind nearly every teacher-learner transaction reported in the CSSE study lay an instructional product waiting to play its dual role as medium and message. They commanded teacher's and learner's attention. In a way, they virtually dictated the curriculum. The curriculum did not venture beyond the boundaries set by the instructional materials.

Chapter 14

PLURALISM AND UNIFORMITY

A teacher on the eastern seaboard told us:

> *One minute it seems everybody wants the same thing.*
> *But the next minute it seems nobody agrees on anything.*

When we talked to a group of teachers or a group of students we were struck by the agreement they expressed as to how science programs and many other things should be. Each may have had a different way of expressing it, or picking up on different details of some "ideal" science program, but they usually pointed with unanimity to a number of large problems that should be taken care of.

DIVERSITY OF WANTS AND STANDARDS

When we moved from group to group or from place to place we found plenty of disagreement. On the more private responses to the questionnaire we found a diversity of views. A Washington teacher said:

> *I think it is important to keep in mind the need for children to have experiences which lead to creative thinking and deductive reasoning.*

and an Illinois teacher said:

> *We need to get right down to the nitty-gritty, the basics, the fundamentals rather than the aloofness, the abstracts. We're teaching abstracts now in the first grade--asinine!*

No reader would be surprised if we announced that from our case study reports, site visits, and national survey we could present a thousand pairs of quotations, diametrically opposed. That would not be proof that people do have different views or respond to different standards of value--for our respondents were reacting to different circumstances, as illustrated so well in the case studies.

In Booklet 15, the Executive Summary, we will contend that when people were talking about educational needs they were speaking more "relatively" than "absolutely", paying relatively more attention to the direction of movement needed to get away from a nearby bad condition, but not arguing that you could not go too far in that way of correcting things. It probably makes them appear to us to differ in what they want from education more than they do.

We wanted to know how our teachers and others in the field perceived the diversity of views of education. We put it this way in our survey:

> Parents, students, and teachers--talking among themselves or with others--say what they watn the schools to be doing. They say different things, but do they really disagree?

Table 14-1
Survey Item: Three Purposes of Education

Each of the three paragraphs below has been said to be THE MAIN PURPOSE of our schools
Which do you think the schools should do?
Please circle one letter below each paragraph.

The HUMAN Purpose of Education

The main responsibility of the schools should be to experience what human society is--the history, human values, work and play, the arts and sciences, what men and women have accomplished and what they have failed to accomplish. The schools should give students the opportunity to be a participant in the human experience, the aesthetic and emotional experience as well as the intellectual experience.

THE STATEMENT DIRECTLY ABOVE TELLS US -- IN MY OPINION -- WHAT SHOULD BE

- (a) THE MOST IMPORTANT TASK OF THE SCHOOLS.
- (b) AN IMPORTANT TASK, BUT NOT THE MOST IMPORTANT TASK, OF THE SCHOOLS.
- (c) A RELATIVELY UNIMPORTANT TASK OF THE SCHOOLS.
- (d) A TASK THAT THE SCHOOLS SHOULD NOT UNDERTAKE.

The KNOWLEDGE Purpose of Education

The main responsibility of the schools should be to help young men and women know all about the world. Each student should have maximum opportunity to study the basic facts and concepts of nature, technology, commerce, the languages, the fine arts and practical arts. The schools should help young men and women build skills for explaining--and even discovering--new knowledge.

THE STATEMENT DIRECTLY ABOVE TELLS US -- IN MY OPINION -- WHAT SHOULD BE

- (a) THE MOST IMPORTANT TASK OF THE SCHOOLS
- (b) AN IMPORTANT TASK, BUT NOT THE MOST IMPORTANT TASK, OF THE SCHOOLS.
- (c) A RELATIVELY UNIMPORTANT TASK OF THE SCHOOLS.
- (d) A TASK THAT THE SCHOOLS SHOULD NOT UNDERTAKE.

The CAREER Purpose of Education

The main responsibility of the schools should be to prepare young people for their life-work. Though most careers require training on the job and continuing education throughout life, the schools should lay the foundation for successful work. For students who will take further training in technical school or professional college, the schools should emphasize entrance requirements and preparatory skills.

THE STATEMENT DIRECTLY ABOVE TELLS US -- IN MY OPINION -- WHAT SHOULD BE

- (a) THE MOST IMPORTANT TASK OF THE SCHOOLS
- (b) AN IMPORTANT TASK, BUT NOT THE MOST IMPORTANT TASK, OF THE SCHOOLS.
- (c) A RELATIVELY UNIMPORTANT TASK OF THE SCHOOLS.
- (d) A TASK THAT THE SCHOOLS SHOULD NOT UNDERTAKE.

After you have circled one letter under each box above please answer three more questions:

HOW ARE THESE THREE PURPOSES NOW BEING EMPHASIZED IN YOUR SCHOOL(S)?

the HUMAN purpose: ___only a little ___quite a bit ___more than the other 2 ___far more than the other 2
the KNOWLEDGE purpose: ___only a little ___quite a bit ___more than the other 2 ___far more than the other 2
the CAREER purpose: ___only a little ___quite a bit ___more than the other 2 ___far more than the other 2

From 246 social studies teachers, parents and superintendents who responded to the question we received these responses:

18% said: People disagree fundamentally as to the aims and responsibilities of schools

63% said: People agree pretty much in principle, but disagree as to how to do the job

13% said: People really are pretty much in agreement with each other as to these things.

So it was clear, to us anyway, that most people do not see fundamental differences in the aims and responsibilities of the schools, but that they do disagree about the ways to deal with problems.

We asked the people in our national survey to indicate the priority that should be placed on each of three grand purposes of the schools. The three were: a human experience purpose, an academic education purpose, and a vocational employment purpose. The explication of these purposes is described on the following page. (Details of the results are in Chapter 18.)

For the moment the important survey finding to consider was that all [illegible] few of the teacher, student, parent, and administrator respondents cited [illegible] as important purposes of the schools. Despite the outcry for more emphasis [illegible] "basics" as described in the previous chapter, it was clear that other aims are still considered important by school people, parents and high school seniors.

As we listened to tapes of interviews and responses to open-ended questionnaire questions we were impressed with what we felt were fundamental disagreements. (Professors can, of course, be counted on to "discover" differences, or parallels, where no other can find the remotest trace of them.) We found many of the opinions expressions of personal or institutional ego, such as this from an editorial of THE WASHINGTON STAR (August 1977) on the findings of the College Board panel studying test-score declines:

> *"We suspect strongly that expressing something clearly and correctly--expecially in writing--is thinking's sternest discipline." That finding, if nothing else of the report survives, ought to be engraved on every classroom wall in every public school--and perhaps printed as a legend on teacher paychecks.*

But we do not suggest that what people want should be dismissed because it is self-serving. On the contrary, the point is that it is important that schools provide educational programs acceptable to a diverse population--and that it would be inappropriate to rule out educational aims because they were self-serving, vulgar, or subject to disagreement.

As indicated a few paragraphs ago, it was not unusual for us to find group agreement as to school aims. In part, that was more an expression of personality than personal commitment. Quite a few do agree, and for one reason or another, others did not declare their disagreement, or they expressed it as an extension or refinement of what had already been said. Goal statements were kept at an abstract level. We could expect to find almost every one agreeing with Thomas Jefferson who noted the following objects of primary education:

> *To give to every citizen the information he needs for the transaction of his own business:*
>
> *To enable him to calculate for himself, and to express and preserve his ideas, his contracts and accounts, in writing:*
>
> *To improve, by reading, his morals and faculties:*
>
> *To understand his duties to his neighbors and country, and to discharge with competence the functions confided to him by either;*
>
> *To know his rights; to exercise with order and justice those he retains; to choose with discretion the fiduciary of those he delegates; and to notice their conduct with diligence, with candor, and judgment;*
>
> *And in general, to observe with intelligence and faithfulness all the social relations under which he shall be placed.*[*]

just as we would expect them to agree with the objectives for elementary science education expressed in one school district (see Table 14-2.) The disagreement usually does not arise until the time devoted to these ends and the sanctity with which it is treated are not known. Then the pluralism of the beliefs in education becomes apparent.

Few readers would disagree that the American society is a hugely pluralistic society. Many citizens yearn for an effective effort by the schools to reduce the heterogeneity of the young. Others wish that the schools would labor longer for the preservation of its subcultures. In the official documents and federal entitlements, today, multiculturalism has the edge. But the clearly dominant theme we have heard in most schools and classrooms, as expressed by the youngsters and elders there, was to bring up all the younger folk to be like those people who run each particular school.

"To model the new after the old" was not an often contested theme. It was not a volatile issue in most places, not, we think, because people really do agree, but because youngsters and oldsters, majority and minority folks, teachers and parents alike wanted the youngsters to share in the privileges and responsibilities of the people who now run the schools, and the banks, and the farms, and the factories. Most, it seemed, would indeed trade a birthright for a larger bowl of pottage.

Most would prefer the impossible--a preservation of their way of life, the honoring of old values, and affluence. When forced to choose most wanted their children to find good work, to have money, to be able to choose their way of life--only half realizing that once you commit yourself to a kind of work and a standard of living, what remains for most is merely the choice of whether to buy a boat or a sportscar.

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[*] "Report of the Commissioners Appointed to Fix the Site of the University of Virginia, etc.," in Roy J. Honeywell, The Educational Work of Thomas Jefferson (Cambridge, Mass.: Harvard University Press, 1931), pp 248-260.

Table 14-2
A School District's Elementary Science "Process Goals"

If our objective is to teach children to approach a scientific investigation in the same manner as a scientist, it becomes necessary to know the thinking processes used by scientists; however, no one method emerges as "the method" because scientists are as individual and different from each other as the rest of us. They have flashes of intuition, they resort to trial-and-error methods, they jump to conclusions and they plod through a wealth of facts and conclusions. However, it is possible to examine how they have refined their thinking and the mental processes.

The American Association for the Advancement of Science in a series of summer institutes with many scientists and science teachers, classified the thinking processes of scientists into schemes and levels.

These process goals are of equal importance to the understanding of the concepts of science and certainly of greater value to a student than the mere acquisition of a body of factual knowledge. The last five process goals stand alone in their cognitive meaning. The first five goals, however, are divided into levels of increasing sophistication.

Observation
Observation of objects, defining the properties of objects, grouping objects into some kind of order for a particular reason.

Communicating
Describing orally or in writing that which has been observed or investigated.

Measuring
Identifying, classifying, and ordering that which can be measured (time, length, volume, mass, density, etc.) and using or making instruments to accomplish the measurement.

Recognizing and Using Spatial Relations
Learning to transfer three-dimensional models into two-dimensional forms on paper. Understanding positions of objects in relations to each other both in fixed positions and when they are moving.

Inferring
Examining evidence and drawing some logical conclusions to what might have caused something to happen the way it did, although the causes may not be directly observable.

Defining Operationally
Simply, this means defining an event by telling what happens. Thus, a circuit defined becomes, "When I put the wires together the light bulb goes on."

Controlling Variables
This implies being able to define the variables first, then leaving one uncontrolled.

Formulating Hypotheses
Similar to drawing an inference. Tentative solutions to problems from observations made, about which some inconsistency exists such as some liquids layering instead of mixing.

Interpreting Data
Understanding what is implied by the data concerning the event, interaction or object which was observed and about which the data was collected.

Experimenting
Determining variables and controlling them in a specific situation for a definite period.

Heterogeneity. It would be difficult to support a contention that the student body as a whole was becoming more heterogeneous. The high school group has just passed its maximum size, but has shown no apparent indication of being the most diverse. The elementary school is nearing a minimum enrollment, but likewise is not apparently more or less diverse than in years past. There seemed to be no premium for individuality of expression, such as there was during the 1960's. Yet teachers are talking about the problems of teaching a heterogeneous class and looking for ways of making it less so. A teacher in GREATER BOSTON nodded toward one boy and confided:

> *He's a "special needs" student, with lots of problems--learning problems and emotional problems. I have to watch him because he might get into trouble because he doesn't know better. We have three or four such students in each class.*

The problem was a classroom problem rather than a district problem. Fewer classes it appears were organized around ability grouping though such grouping continues to be very common. Public Law 94-142 provides for the mainstreaming of handicapped youngsters, requiring that they be educated under "the least restrictive" conditions.

The community appeared to be upset by absenteeism from school. (Teachers in WESTERN CITY frequently mentioned it as a problem. Math classes there were listed as averaging better than thirty students per class, but field observations put it closer to twenty, p 7:14.) Rules against absenteeism may be tightening. The courts were limiting school-official use of expulsion as a punishment for student misbehavior. Absenteeism tends to reduce heterogeneity. We do not have good data on it but the classes may be becoming more heterogeneous--we do know that is an expectation that many teachers have.

We asked our national sample of high school social studies supervisors, high school math teachers and elementary school principals whether or not increased heterogeneity of students as to learning ability and motivation is a problem for the classroom teachers. The question and the answers were as follows:

> For a number of reasons students in many classrooms are becoming (as a group) more and more heterogeneous in learning ability and motivation. Is this a major problem for teachers?

Portion of Sample Responding	Response: "Yes"	"No"	"I don't know"
150 of 201 High School Social Studies Supervisors	45%	20%	35%
92 of 150 High School Math Teachers	49%	23%	27%
57 of 94 Elementary School Principals	55%	37%	8%

(Percents are of people responding, weighted by sampling plan; standard errors in Chapter 18.)

> If this is a major problem, what should be done about it?

An elementary principal from New York City said:

> *Better teacher training, smaller classes, provision for grouping.*

A supervisor from Arizona said:

> *The problem can be helped by small group instruction within the classroom. Individualizing the program to meet the needs of the students*

> *within the group. Not using the same textbooks, materials and equipment for every child. The content must fit the needs of the student and be on a level they understand.*

A high school math teacher from New Hampshire said:

> *I wouldn't want to see 10 different tracks for each area of student ability. Yet it does become difficult to teach if there is a wide range of abilities. Some students are bored; others are lost; and only a few are being motivated.*

An unusual response came from a social studies supervisor in Ohio:

> *One answer is a carefully designed computer supported instructional program which could allow teachers to develop a curriculum for each student.*

Most of the practitioner respondents who answered this question on our survey instrument indicated that ability-grouping, smaller classes, and use of aides were the ways to deal with such a problem. Several respondents apparently did not feel that there were constraints that limited the school in dealing with the heterogeneous classroom. One principal replied:

> *Obviously, become less heterogeneous and more homogeneous. (Stupid question)!*

Even though some do not see the problems of making classes more homogeneous there was good evidence that heterogeneity is a pedagogical problem.

Special Education. The traditional arrangement in the schools has been to have the teacher give special instruction to individual children within the classroom, and to provide special rooms or specially trained teachers for instructing those who could not benefit sufficiently from or who would impede the group instruction. The arrangement is being called into question as indicated in subsequent sections. We were interested at our field sites in special program provided in math and science for students to whom the regular program was not well accommodated. We were favorably impressed with a program at URBANVILLE arranged to permit wheelchair-bound students (from Hardy and other districts) to participate in regular classroom activities. Special remedial math classes were available there and in most of our CSSE high schools for "slower learners."

We asked math teachers:

> In your school what special efforts are made to help students who have special talent or extra interest in math?

From North Arlington, New Jersey: *They work on individual skill development kits, SRA algebra kits, math projects, lives of mathematicians, various games, and geometry activities.*

From Franklin, Tennessee: *Some of these students compete in a math contest sponsored by a university in our area.*

From Warren, Michigan: *Some can enroll in community college math courses.*

From Sheboygan Falls, Wisconsin: *In junior high we teach 6 different levels of math combining 7th and 8th graders in the same class if they have the same ability.*

From Rancho Cordova, California: *Computer programming*

And we asked science teachers the same question about science and were told:

From Tyrone, Pennsylvania: *They can act as science lab assistants.*

From Aberdeen, Maryland: *An advanced special studies program. My laboratory approach Physical Science is self-paced so that students may progress as far as their abilities take them.*

From Dundanville, Texas: *Participate in Westinghouse Science Competition and contests sponsored by colleges.*

From Durango, Colorado: *Knowledge bowl, field trips, special assemblies.*

We asked secondary school principals the following question:

> Every school has students for whom learning comes slowly and with difficulty. Is any special effort made in your school to help these students gain an understanding of science?

From East Brunswick, New Jersey: *There is a science program for everyone. IIS seems to do well by our slower learners.*

From Brooklyn, New York: *Reading in science--a reading class using science as the vehicle.*

From Benton, Arkansas: *A low level class in biology is offered to help slow students meet their biology requirements.*

From Minneapolis, Minnesota: *EMR and Special Education Resource Room*

The professional field of special education, relatively well funded by federal programs, has become highly specialized and technical. Increasing demand is placed on the specialist for classification of learning disability and specification of instructional conditions. These specialists seemed not to be involved in subject matter problems, such as what science to teach, at our CSSE sites. (A brief commentary on mainstreaming and PL 94-142 comes up in 3 or 4 pages.)

Engagement in Instruction. One parent from Atlanta wrote an unusual answer to our question about today's biggest problems with which the public schools must deal. He said: "teachers that don't do a day's work." The answer was unique. There is rather widespread agreement that teachers do carry a heavy workload. The critics we encountered faulted teachers for pursuing the wrong aims or for incompetence, almost never for lack of commitment.

Yet, for all the energies devoted to teaching, the quality of instruction was dissatisfying to many within and outside the schools. They saw it in many different ways. The answer to that question about the school's biggest problems ranged as widely as the sources, as the following examples show. But for the most part they collectively tell the many ways that prevent teacher and student from engaging in effective instruction.

Anchorage parent: *satisfying the public demand for the 3 R's--parents are fed up with youngsters not reading, knowing no history, not learning the things they learned in school*

Hawaii student: *getting the students in school and set some sort of motivation for them*

Southern California science teacher: *community apathy; lack of support from district office*

Colorado Springs parent: *lack of basic educational requirements; lack of parent guidance at home in insuring a desire to learn*

Minnesota science teacher: *vandalism, apathy, reading, budget*

Wisconsin counselor: *fiscal support*

Akron student: *the student who doesn't try and yet complains about hard work*

Kentucky counselor: *drugs and the whole "welfare concept"*

North Carolina counselor: *lack of competent and innovative curriculum supervisors*

Newport News science teacher: *attendance, behavior, reading*

Western Maryland science teacher: *elected school board responds to pressure groups; too much spent on school construction, not enough for instructional materials; too many administrators, coordinators, etc.--this makes classes very large*

Suburban Philadelphia student: *social problems of students, such as drugs, pregnancies, run-aways, suicides. Let's face it, you're here to help train the kids; you might as well help them to completely fit into today's society.*

New Jersey parent: *Back to basics--competency in reading, writing, math, science and social studies--but not (as here) through regimentation and the resultant conformity for both teacher and taught. Seems to me that individualization and modular scheduling is a requirement for good education. The traditional system, of course, makes it much easier to teach the SAT, impress the PTA, etc.*

The most common problems cited by administrators pertained to the testing of students. Students also most frequently mentioned problems (for the schools) having to do with testing. Curriculum supervisors more frequently cited fiscal problems. The teachers more frequently mentioned discipline problems.

We had expected more general identification of *student discipline* as a major problem for the schools. We recalled the results of the Gallup survey which had citizens naming it as the top problem.* We recalled recent cover stories of *Newsweek* and *Time* and stories in other news magazines and papers highlighting hostility and disruption in the schools:

> *Ask almost any teacher what he or she considers the top problem in the changing city classroom and the answer will be "discipline."* (*Newsweek*, 9/12/77)

We thought such stories might have crystallized the impressions of what the big problems were--but apparently not. There was widespread concern about misbehavior in schools, but it was not apparently seen as the "problem of problems" with our parent respondents or with others than the teachers. Not surprisingly, the teachers saw it more clearly as a major obstacle to providing good instruction.

Perhaps the most important academic aspect of the matter of behavior control was that time available for recitation and study was greatly diminished, perhaps even up to 50% in some classrooms, by confrontations between teacher and student, or between student and student, or the deliberate attempts of youngsters to distract individuals or the whole class from the lesson.** Some of it is contentious, much of it is devilish humor such as Mark Twain or Fellini would delight audiences with, but it aggregated, especially with some teachers and in some schools, to limit the students' opportunity to "do their lessons."

In an American history class in GREATER BOSTON one student interrupted the teacher's discussion of Roosevelt's program for economic recovery with: "May I interject? Who's going to the prom?" Later the teacher said she didn't like the lack of discipline but "a relaxed attitude was necessary to keep the school going." (p 11:48)

A cadet teacher in Illinois was confronted with: "You can't keep us [after school]. We gotta ride a bus."

It is easy to suppose, in our effort to be good researchers and good social planners, that the classroom should be a business-like place, sober and industrious. Many clearly wanted it that way; others preferred the natural ambiance of a good-working, happy-living family. In speaking of lack of discipline here we are not commenting that we have found little of the sober and industrious. In fact we found it everywhere. It was by far the

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*George H. Gallup, "Eighth annual Gallup poll of the public's attitudes toward the public schools," *Phi Delta Kappan* 58 (Oct. 1976): 198. We used the same language in our question and coded the open-ended responses according to the category labels Gallup reported.

**In Chapter 16 (The Teacher in the Classroom) we will describe more in detail how great is the effort of the teacher to maintain social discipline--often even in situations in which there is no apparent imminence of misbehavior--and to treat instruction in "proper behavior" as more important than instruction in "academic knowledge and skill." Cases of classroom "guerrilla warfare" are succinctly illustrated in the ARCHIPOLIS case study (see p 9:13ff).

prevailing atmosphere in the schools we observed. We found a large number of classes where there was a more informal, personal relationship, often spending less time on a common objective or exercise, but often engaged in the study of important and complex problems, of a scientific nature and otherwise. But we also found, as did Tikunoff, Berliner and Rist* that a great deal of the total classtime in any class was not spent on what it was scheduled to be spent on, that the classtime was devoted to administration and socialization. And that beyond that, in some classes a large portion of time was lost to confrontation and distraction. The increasing disability of teacher and school to deal with this problem is described in the following sections.

EQUAL EDUCATIONAL OPPORTUNITY

In 1971 policy analyst Thomas Green said:

> *For the next decade, and beyond, the attainment of equal educational opportunity will probably be among the most fundamental and intractable issues confronting American education.***

In the schools we visited in 1976 and 1977 the issue was not frequently discussed, but the quest for equal opportunity manifested itself in many ways.

Equal opportunity can be defined in different ways, the providing of equal financial resources, the providing of equal support of all kinds, the providing of whatever support needed to allow each who so chooses to reach a certain attainment, or the providing of whatever support it takes to guarantee that each attain at least a certain minimum. The difference is academic. The direction of improvement is obvious. So far most of the districts we visited have not moved beyond the simplest of standards, of equity--providing equal fiscal support. And well-publicized fiscal disparities were apparent to our observers within the impoverished schools of ARCHIPOLIS and PINE CITY and the affluent schools of BRT and ALTE.

It is not the fiscal provisions that concern us here but the more fundamental differences in opportunity to learn, involving the competence of the teacher, the quality of the learning materials, the learning place(s), the peer group of students engaged in learning.***

It appeared to us that the schools actually do quite well in providing a parity of spaces and books suitable to the task. The teachers fell short of the ideal, especially in the poorer schools but even there there were often the strongest of the ingredients. What became obvious to us in these studies was that many of the poorer schools cannot provide a learner with a classroom of fellow students who can and will use a great portion of the lesson period for learning.

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*W. Tikunoff, D. C. Berliner, and R. C. Rist, An Ethnographic Study of the Forty Classrooms of the Beginning Teachers Evaluation Study: A-Known Sample. Technical Report #75-10-10-5 (San Francisco: Far West Laboratory, October 1975).

**Thomas Green, "Equal Educational Opportunity: The Durable Injustice." (Paper presented at the Proceedings of the 27th Annual Meeting of the Philosophy of Education Society, Dallas, April 4-7, 1971), p.121. Reprinted in C.A. Tesconi, Jr., and Emanual Hurwitz, Jr., eds., Education For Whom? (New York: Dodd, Mead and Co., 1974), p. 80.

***See, John Elliott, "The Problems and Dilemmas of Mixed Ability Teaching and the Issue of Teacher Accountability," Cambridge Journal of Education 6 (Lent Term 1976).

Please consider the revealing illustrations starting on page 9:13 of the ARCHIPOLIS case study. This would not be a typical classroom scene in ARCHIPOLIS, but neither it uncommon. We could present others from that same classroom where the students are fully engaged in learning. We could provide large contrast--though not so large in most--from any of our eleven sites. We could present others where it was merely a pocket of youngsters who withdrew from learning endeavors. The finding that we believe so important is that confrontation and loss of time were common in three of our eleven sites, enough so that perhaps half of the learning time in certain classes was thus dissipated, and that confrontation and loss of time were not uncommon in any of the districts. There are bound to be disagreements wherever people are in contact, and no enterprise is all business and no play--but playing and fighting were a major competition to teaching and learning in several of our CSSE schools.

Teachers in schools like ALTE and FALL RIVER were anxious to prevent such erosion of control (and scholasticism), even if it were to result in greater equality of opportunity. The bastion seems particularly threatened in a school such as the Bronx High School of Science, now facing a challenge by the U. S. Office of Civil Rights regarding its disproportionate enrollments of white and male students. According to a story by Marcia Chambers in the New York Times 7 November 1977, school officials and students are persuaded that high cutting scores on admissions tests are essential to keeping a high quality educational program for the city's academically superior students. Such a direct confrontation was not apparent in any of our CSSE schools, but the issue was just beneath the surface in PINE CITY, URBANVILLE, and GREATER BOSTON--and quite visible in ARCHIPOLIS.

Great effort has been made to increase educational opportunity by increasing the access of students to schools and classes that once were closed to them. Access for many lower-class and non-white children has improved but the quality of educational opportunity to them is neither equal to that for most middle-class white children nor satisfactory. Even among those who have supported desegregation on moral grounds we found little optimism that improvement in opportunity was likely to come through further desegregation efforts. Few teachers have an answer to the problem, but they are bent on helping out by increasing the efficiency of teaching, particularly for those who come to school with little scholastic preparation.

Traditionally the teacher's job has been to arrange the situation, to present the lesson, and to direct the activity of the youngsters. Recently, there has been increased attention to the quality of performance of the student, especially in "test" situations. The teacher has been challenged by parents and others: achievement performances are not good enough, and especially with so many things to be taught, the teacher should be more efficient in bringing achievement up to standard. The teachers were sensitive to the criticisms, and in fact have led the way in URBANVILLE and RIVER ACRES and elsewhere in calling for greater efficiency in teaching, that is, more "output" for a given amount of "input." Certainly, the new cadre of school administrators has encouraged them to honor "efficiency."

As suggested in the previous section, the teachers way of getting better results, of being more efficient, is to group the students according to ability, to individualize instruction, and to use more rigorously defined lessons with specified criterion tests. The major obstacle, it often appeared, what works against these efforts to be efficient and effective, was the student. Not just his poor background, but his lack of commitment to learning, his distractability, his defiance of authority,-- hers too, of course. And these obstructions are not neatly contained so as to obstruct only the learning opportunity for that learner, but spill over to impede the whole class. The teacher looks for ways of intimidating or cajoling, often without success. The teacher seeks to isolate or expel the misbehaving student, often without success.

Mainstreaming. Governments, including the judicial branch, have not been content with the efforts of teachers to provide equal educational opportunity. In 1954 the Supreme Court turned down the philosophy of separate-but-equal schools,-- ruling that a child was denied equal right under the law if, on the basis of race, the child was denied the opportunity to attend class with other children. The courts ruled that it was not only the obligation of the state to provide equal access, but to take initiatives, such as to bus children across neighborhood boundaries, to achieve integrated classrooms. One effect of these rulings was to increase the expectation that the students within a classroom would be a more heterogeneous group in many ways including experience, ability and aspiration.

Most teachers that we talked to were sympathetic to the effort to restore equal learning opportunities to the underprivileged, but were dismayed by the increased difficulty for the teacher and apprehensive about the future. They were seeking ways to make the teaching more efficient and felt the heterogeneous classes make it less so. The contention here, between equity and efficiency, is similar to a great economic debate cited recently by columnist David S. Broder (Washington Post, 10/26/77). Broder called the debate over oil and energy "a foretaste of the basic economic argument of the next decade," a debate pitting "equity vs. efficiency". He quoted John T. Dunlop, an economist:

> *If I were to pick out any single subject . . . as the challenge to this economy in the future, it would be the complicated problem of the interaction of the political process and the economic process and the different ways in which those two arenas tend to be approached. . . . the considerations of politics are centered very highly on equity, whatever that word means. On the other hand, the economy keeps talking in terms of efficiency, in terms of cost and benefits and such criteria. And those two are often very different worlds.*

The situation in education is similar. The professional concern is to get the lessons taught, to get children to learn, to move through the syllabus expeditiously. The political concern is to utilize the schools as an instrument of social improvement, to make life in the schools a more ideal life (politically) than natural forces provide in the private spaces of home and business, to guarantee that rights to an education and privileges deriving from an education are extended to all. And though equity and efficiency on occasion work side by side, each signals the concern of two very different worlds, and will sometimes be in confrontation.

The most recent obligation to return certain children to the mainstream of education has been in the area of special education. Public Law 94-142 is a comprehensive 1977 law for the education of handicapped children. It requires that these youngsters be taught in "least restrictive environments," with teachers not given final say as to whether a child can profit from the regular classroom, nor assured of assistance with the extra time demands and in-class distractions. We found teachers distressed by these prospects and administrators persuaded that the regulations were terribly costly and probably unworkable.

Tracking and Grouping. As indicated earlier, many teachers' answer to the problem of heterogeneity of students was homogeneous grouping (primarily according to ability) within the classroom if it can't be done by assignment to classrooms. The grouping would be primarily by scholastic ability but would consider motivation and activity as well. A biology teacher in GREATER BOSTON said:

> *The real problem here is trying to teach classes where some students want to learn, and perhaps plan to go to college, but where these students are mixed in with other students who don't much care and who took biology just because they like the idea of cutting up frogs.*
>
> *You can't teach to the level of the good students because the rest get bored and start disrupting the lesson and it gets so you can't like to let the scalpels out. And you can't teach to their level, because then the good students feel you don't care about them, and then they get bored and complain that science isn't really very interesting.*
>
> *The only answer I can see is to separate the two groups, so that at least you get those students who are interested and want to learn science in one group.*

The problems of elitism and equal opportunity are further developed in the continuation of this interview as reported in Rob Walker's case study on page 11:12ff.

When educators speak of "tracking" they usually mean the assignment of students into groups to be taught with different long-term objectives in mind, with their lessons to differ usually in complexity and comprehensibility of the subject matter. Once the students have been assigned to tracks it is not expected that they will return to a single track or the same group again for learnings in that subject matter. This kind of tracking was ruled an unconstitutional denial of rights in Hobson vs. Hansen, a landmark Federal court decision in Washington D.C. in 1967. It had been brought to court in order to admit black students to the advanced courses available then within the District largely only to white students. Our CSSE staff interviewed a few Washington, D.C. teachers with regard to the present condition there. They reported that as they saw it the courts had gone too far in keeping classes open, in requiring students to remain with their original heterogeneous groups, and particularly in requiring that problem children be returned immediately to the class rather than be detained in some way. The teachers we talked to were black, and saw themselves not as impeding the cause of civil rights, but as facilitating civil rights by providing a good education to those who would accept it, and keeping them unencumbered by those who would not.

"Grouping" is a term used (often in contrast to "tracking") to indicate temporary assignment to learning groups to facilitate study toward common objectives. Technically speaking, the members of groups can be returned to the class as a whole for further instruction in the subject matter. By good performance on subsequent testing any child might be reassigned to a faster learning group, thus the permanence of segregation by tracking is not built in. Restoration of a slow-learning or poorly-motivated child to the regular group can be difficult to arrange without postponing the next sequential assignment until the slower learners have had a chance to catch up. To insert some enrichment assignments may work, but it is an extra burden on the teacher and is seen by some parents as unnecessary delay, and in fact it is the introduction of different learning objectives to different groups, which was part of the definition of tracking. As it usually works out, homogeneous learning groups do differ with regard to the pace of learning, with regard to the enrichments or breadth of learning,--and it is rare in most classrooms for a student to move from a slower group to a faster group. Yet homogeneous grouping is the best hope that educators have come up with for the problem of providing (at minimum cost) good learning experiences for children in heterogeneous classes.

We asked parents and principals how they felt about this matter, concentrating on the effectiveness and fairness of homogeneous grouping. The results:

		46 of 86 Jr Hi Principals		58 of 94 Elem School Principals		111 of 250 Parents of Seniors	
		n	%	n	%	n	%
Do you feel that grouping youngsters of similar skills and experience into learning groups or tracks generally makes instruction more effective?							
	Yes	23	50%	31	53%	92	83%
	No	10	22%	22	38%	16	14%
	Other	13	28%	5	9%	3	3%
Do you believe it is unfair to some youngsters if there is sustained and heavy emphasis on such homogeneous grouping?							
	Yes	32	70%	44	76%	58	52%
	No	13	28%	13	22%	45	41%
	Other	1	2%	1	2%	8	5%
Considering both teaching effectiveness and fairness, which is the best policy?							
Put youngsters into tracks according to their learning ability		5	11%	5	9%	33	30%
Don't use tracks but use grouping as much as is needed for good instruction		23	50%	32	55%	46	41%
Occasionally use groups for a short while: occasionally group dissimilar kids		9	20%	16	28%	25	23%
Except for very special activities, use no homogeneous groups for instruction		5	11%	3	5%	5	5%
Other		4	9%	2	3%	2	2%

(Percents are of those who responded, unweighted. Standard errors are not available.)

The two groups of principals responded the same, seeing grouping or tracking as making instruction more effective, and agreeing substantially that it can be unfair if sustained. The parents were somewhat more supportive of grouping, disagreeing as to whether or not it might be unfair to some. It can be concluded, we believe, that the potential effectiveness and potential unfairness of grouping was widely recognized. The compromise most favored appeared to be on the side of using grouping (but not tracking) as much as is needed for effective instruction.

One of the reasons* given for opposition to homogeneous classes was that it tended to increase the likelihood that a poor student would be assigned a poor teacher, as this Colorado computer science teacher said:

> *The real problem is with these students who would like to take additional courses in mathematics but are mathematically very immature. . . . Their needs are not being met. (Teachers are not motivated to teach this level.) College preparation does not prepare you to teach this type of student. (Those students get the worst teacher.)*

But the greater problem was probably the stigma of discrimination, expressed in an eloquent observation on pages 1:15 and 1:44 of the RIVER ACRES case study (it was in RIVER ACRES that we found the most carefully articulated grouping** operation):

> Students are grouped for instruction in mathematics from first grade through high school. In the elementary grades children are grouped for reading as well.
>
> In junior and senior high school the students are grouped in science and social studies too. By the senior year of high school there is an enormous difference between the top group and the second and third groups. Another sizable ability/achievement gap occurs between the third and fourth groups. It takes an exceptionally talented and dedicated student to do top group work in all subjects at Central High School according to students, teachers, and parents. Level One never comprises more than 5% of the class and is often less than that.
>
> Although teachers claim the average student is at grade level (at two grade schools) they feel deeply about their instructional ineffective-

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*Another potentially serious problem of grouping is the likelihood of reinforcing negative behaviors. For commentary on the interrelationships between academic and social grouping, see Phillip A. Cusick, Inside High School: The Student's World (New York: Hold, Rinehart and Winston, 1973). For an earlier review of ability grouping see Urban S. Dahllöf, Ability grouping, content validity, and curriculum process analysis (New York: Teachers College Press, 1971).

**Though the levels are prominent and acutely distinguished in RIVER ACRES, they are not "tracks." Any student requesting movement from level two to three or the reverse was honored, and also movement to and from levels one and four--if the counselor concurred (p 1:78).

> ness for poor and many average students. It has nothing to do with science per se.

And a Texas junior high teacher made a profound comment to the case study worker in RIVER ACRES (p 1:44):

> *I have no earthly idea what they have had when I get them in the fall [Sixth grade]. The key to it all is placement. When we place 'em in the right level things go pretty well. [The counsellors do most of the placing of the students initially.] Level 1 really hums, level 3 is good for individualization. Level 2 is a wide mixture. They are so diverse. They could be 1's or they could be another "zoo."*

The "zoo" reference was to a particular group of level 3 students that had been exasperating each teacher who worked with them.

The core content of science instruction is similar across the three levels. The "Ones" get it all, and more. They can volunteer to be assistants to wash equipment, set up demonstrations and are allowed to use non-chemical non-flammable equipment. "Top-group competition is fierce," said one teacher, (and added):

> *We need a low-reading curriculum for the low Threes in science. I take level Two material and condense it for the Threes. They just don't care or they are LD [Learning Disability] kids. Some just can't work in a large classroom. So I cut out the details and just give them basic understanding, orally. Nothing in depth is possible. You can't plan for a level Three class in science. (Competition does not work). Just begin by talking and move on. (p 1:44).*

How spontaneous and challenging a science class experience in Level One can be is also illustrated on page 1:44 of the RIVER ACRES case study.

According to field observer Lou Smith, classes in the ALTE high school were grouped, not directly by counselor assignment nor by aptitude scores, but by sequential course prerequisites. In order to take a first course in physics a student was expected to have first taken or to be simultaneously enrolled in algebra, quantitative science, quantitative chemistry, trigonometry, and possibly "Biology Q." None of these ninth to twelfth grade courses in this sequence of prerequisites was in itself a requirement for graduation in ALTE. Therefore it was a most select group, though untracked, that was permitted the experience of the high school physics laboratory.

The ALTE high school math program was even more sequential than the science program. The social studies program (predominantly history) was less sequentially oriented. The classes as expected, then, were in mathematics more homogeneous and in history less homogeneous with regard to within-class student characteristics.

In the advanced math class at WESTERN CITY the following ethnic distribution was noted by observer Rudy Serrano:

> 15 Anglo students; 3 Oriental students; no Chicano or Black students;

whereas in a general math course the distribution was:

> 10 Anglo students; 8 Chicano students; 8 Black students; and no Oriental students (p 7:29).

The more homogeneous enrollments, such as the advanced math enrollments at ALTE and WESTERN CITY, are the delight of many high school teachers. They know students in these classes are going to learn an immense amount regardless of how good the teaching is--if the students do not refuse to learn. Most teachers who know how to keep up with such students do what they can to get such enrollments in the courses they teach.

Alternatives. One form of tracking that is not of questionable legality is individualized instruction. Many teacher , particularly in the area of mathematics see individualization of instruction as an approach that is both efficient and fair. At FALL RIVER's East Junior High School, the teachers

> decided to build an individualized math program as a way of coping with the highly variable math skills the students brought with them. The teachers examined published curriculum packages and visited school districts with a program they viewed as compatible, they asked the district office for money to support collaborative development. Once the program was developed, however, the teachers found that over half of the students could not work effectively on their own.
>
> This year they made an adjustment, starting with everyone (except the students who elected algebra), they reviewed whole numbers and fractions, then gave a placement test. The high ability and eager students were put into the individualized section. The rest were grouped by ability levels and taught in structured classes (p 11:18).

In this community there are elementary schools participating in PLAN, an indivualized computer-managed instructional program in language arts, math, science and social studies. The complexity of the advocacy and opposition to PLAN is nicely revealed on pages 2:20ff of Mary Lee Smith's case study.

Another way of dealing with the problems of heterogeneity of learners is the use of learning centers or learning labs, special rooms with special teachers and special materials. In VORTEX Gordon Hoke talked to a young man named Joseph who directed a Math Lab in one of the elementary schools (pp 10:11f).

> I raised a specific question concerning the level of test diagnosis, referring to a study conducted by one of our research assistants who concluded that gross difficulties, which teachers already grasped, were the main product of test utilization, with instructors receiving little aid in pinpointing a pupil's idiosyncratic needs. Again, Joseph remained steadfast in his praise of the test materials.

His testimony was important because it reflected a dozen years of mathematics instruction in elementary schools plus seven as an instructor in the VORTEX Basic Skills program. Joseph then explained:

> *We work around their schedules as much as possible. Don't want to create "hostile" kids because those who come in here have a history of failure, after all, that's how they get here. The lab is not "instead of" but is "an addition to." Our focus is strictly on the individual and his need for skills improvement. The "Company" has urged us to do more small group work at the table here, but I'm opposed. We do combine episodes with the hardware with pen and paper reinforcement drills, but our main purpose is to make this period as different as possible from normal classrooms.*

Even though an affluent, self-sequestered surburb, our site at ALTE also enrolled a heterogeneous student body. A single curriculum, and even a single high school, was insufficient to handle the diverse aims and backgrounds of its people. With 90% of the students going on the college, the student who would be an ordinary student elsewhere was in a minority there. In ALTE they called them the "silent majority"--though they were neither. Special courses were arranged for them. In the slow algebra class our observer saw 15 students, 12 following the teacher through the intricacies of quadratic equations, three of them "tuned out," perhaps unable to keep up. According to Lou Smith's notes a science teacher was moved to say (p 3:100):

> that the courses in the science area at ALTE were too difficult for some students in the school. . . . said the entire curriculum was designed to make the student think critically. Some could not. There was nothing for these students. . . . felt that something should be done for these students.

In 1972 an "alternative school" was set up in ALTE (p 3:101) because

> a significant number of students, both academically able and those with problems, have expressed a desire to "drop out" unless something broader and more immediate is offered.

At the alternative school as many as five per cent of the ALTE high school students could take a special program. The observer noted the social sciences there being (p 3:102):

> more oral and less bookish, more immediate and practical and less remote and theoretical, more group-involved and less individualistic, than social science at the high school.

Whether or not the alternative school program was a suitable program continued to be debated across the community. Our observer found the issues about the alternative school intimately related to the question of whether or not a school system should honor the pluralistic disposition of the community--one that appears to many outsiders as extremely homogeneous.

Alternative schools have been dismissed by many analysts, partly because they leave such little record of accomplishment and partly because they have had in many places a short life span. Neither is a good basis for evaluating their worth. A more careful look at them, such as one proposed by educational philosopher Mary Anne Raywid of Hoftra University*, is needed, particularly as new forms of alternative schools such as the fundamentalist and basic skills alternative schools are established. It has been suggested that the alternative school is an escape valve for youngsters or parents who reject what the system has to offer. They need also to be looked at as an escape valve for the system, that is, a device that permits them to continue functioning as they have in the past. Other alternatives, such as open enrollment, optional types of report cards, and teacher option curricula are also suggestive of this.

A more modest form of alternatives to the regular school is that that takes traditional programs and links them together in new ways, keeping science as a part of the academic program but capitalizing on the vast--and often unexpected--opportunities for learning in everyday living. In PINE CITY observer Rob Walker expanded on such a form (pp6:23f):

> . . . I had in mind a vision of an alternative pedagogy I think shared by many science educators. In fact it's more than a vision because you can see it in action not more than a few minutes walk from the classroom in the Trade School, and perhaps particularly in the Auto Shop. . . . The teacher is available as organiser, consultant and supervisor rather than as curriculum ringmaster. . . . The students in the Auto Shop work as essentially apprentices rather than as clerks and collectors of information.

Ironically, praise for the Trade School and its teachers spotlights the history and influence of a dual school system in the South. For the facilities and instruction were originally identified with an institution where members of the segregated student body were prepared solely for the world of work. Desegregation had brought heterogeneous classes and new options for both white and black.

Our site visitors also were impressed by the vocational programs in PINE CITY, paying special tribute to the integration of metrics with conventional assignments. During the week of the visit PINE CITY's elementary schools were featuring ties between science, nutrition, and eating habits: bulletin boards, corridor signs, and classroom decor carried the messages.

In a section termed "The Voices of Students," (p 6:30), Walker recounted the experiences of several Pine City youth trying to interpret the meaning of their lives in this rural setting.

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*Project on Alternatives in Education, "The PAE Story," John Dewey Society, (Columbus: Ohio State University, May 1977).

Tony, a seventh grader, "loves the outdoors and spends much of his time fishing and hunting." The observer quoted Tony as saying: "Science is not easy, there's a lot of studying, but it is interesting." The boy is an avid viewer of Cousteau films and Wild Kingdom, and thinks he would like to be a marine biologist. Tony is very observant, we were told, an eager collector of information. "When you go out in the woods you never quite know what you will find," he told Rob Walker. Rob concluded by stating that

> fishing specially is almost a science to Tony. . . . He seems to store each of [these] facts away in his mind as he encounters them, and enjoys the opportunity of talking to knowledgeable adults about them whenever he gets the chance.

The "chance," whether it comes from participation in an outstanding classroom or through encounters with resources in the larger environment, is not easily arranged. Walker succinctly phrased the challenge facing educators when he finished his brief tale of the shop classes by writing:

> It is possible for science too to be taught along these lines. . . . but like the Auto Shop it would require the provision of space and equipment as well as special kinds of teachers.

The community has been as much a barrier as an opening to opportunity. Jennifer, a PINE CITY graduate nearing the completion of a two year college program, cautioned us (p 6:42):

> *There's a big red line [of segregation]: some restaurants will not serve blacks there are two community centers--one black, one white; and a number of jobs still closed to blacks. They have a line, and it's going to take some pushing to get past it.*

Jennifer, we were informed, was one of five black students enrolled less than ten years ago by parents in an all-white sixth grade--under a new doctrine they called "freedom of choice."

Whether or not the alternatives suggested here do in fact contribute to equal opportunity of education is not at all apparent. What they do satisfy in many instances is the felt-need for a better opportunity. Again the question arises as to whether it is the school's responsibility to provide instruction that will satisfy a court's standard (or a researcher's or philosopher's standard) or whether it is the school's responsibility to satisfy the expectations of students and parents and other citizens.

ARTICULATION OF TEACHING OBJECTIVES

Faced with a diversity of expectations and standards, a sometimes trying heterogeneity of students, and continuing claims of inequity in educational opportunity, the schools have sought to hammer out agreement as to their high priority responsibilities. People in and out of school have generally agreed that it is

important to be more explicit about goals--for diverse reasons. We asked principals, supervisors and parents the following question:

> In one city recently science teachers in elementary, junior high and senior high schools expressed a strong desire to clarify what should be taught in each grade. What do you think are major reasons teachers seek such clarification? (Check one or more)
>
> ___to make their jobs more manageable
> ___to locate the blame when deficiencies were found
> ___to make clear to students what is expected of students
> ___to persuade Board and Community to support some areas better
> ___to select the best text materials from the huge supply
> ___the reasons are different from community to community
> ___there really are no reasons; maybe it's just a panic response
> ___other (please specify

The responses[†] were as follows:

HIGH SCHOOL PRINCIPALS 54 responding of 87 sampled	ELEMENTARY SCHOOL SCIENCE SUPERVISORS 134 responding of 210 sampled	PARENTS OF HIGH SCHOOL SENIORS 142 responding of 250 sampled	
52%	50%	44%	__to make their jobs more manageable
22%	11%	23%	__to locate the blame when deficiencies are found
61%	59%	51%	__to make clear to students what is expected of students
11%	7%	20%	__to persuade Board and Community to support some areas better
32%	35%	33%	__to sleect the best text materials from the huge supply
35%	25%	25%	__the reason is different from community to community
2%	4%	7%	__there really are no reasons; maybe it's just a panic response
17%	21%	5%	__other

[†] Percents are unweighted percents of those responding. Standard errors are not available.

Statements of objectives. For several years teachers have been engaged in writing or choosing course objectives--constructing lists or matrices of aims, topics, competencies and desired student behaviors. They have sought consensus with community blue-ribbon panels, student councils, parent-teacher organizations and others with interest in what will be taught. The aim has been to fix upon a school program that would be acceptable to all concerned.

Full agreement is hard to find. For the most part committees have operated in good faith; considering majority and minority views; acknowledging unique local conditions, teacher perogatives and individual differences among students. But they have felt compelled to reach consensus. One usual result is for the statements

to be made up of global and non-controversial aims. We heard a few interviewees at our CSSE sites complain and we wondered generally if people had misgivings about these statements being overly simplistic. We asked our national questionnaire respondents about the following claim:

> Authorities are urging teachers to be more specific about instructional goals. If curriculum guides and lessons do get much more specific, the curriculum will over-emphasize simplistic skills and memorization of isolated facts.

Percent of people agreeing with the claim:

	Large city >100,000	Large Suburban	Non-Metro <100,000	TOTAL	Number Responding
___ Teachers	36%	58%	44%	44%	176
___ Curric Supr's	74%	32%	40%	41%	229
___ Administrators	93%	42%	21%	38%	75
___ Students†	39%	37%	42%	42%	242
___ Parents †	46%	41%	18%	18%	133
	West	Midwest	South	Northeast	
___ Teachers	54%	42%	28%	42%	
___ Curric Supr's	60%	35%	51%	35%	
___ Administrators	56%	37%	26%	4%	
___ Students†	57%	47%	57%	46%	
___ Parents †	29%	37%	43%	39%	

Standard errors are not available for these weighted percents.
†unweighted percentages are used for students and parents

Teachers and curriculum supervisors in many districts have gone on to specify further the more detailed immediate objectives, lesson by lesson, the steps to be taken to accomplish the larger aims. The galaxy of facts and operations that constitutes even an average eighth grader's education of course greatly exceeds the catalogue of specific objectives in any school program. Most teachers have a tacit knowledge of how complex and personal an education is, and each works to further those many educations--but many teachers find it difficult to justify time spent on personalizing classroom learning. It is so much easier to justify time spent on those several objectives specified in the syllabus. As greater stress is placed on teachers, they increase their attention to the specified aims, for good or ill. Many teachers believe the movement to pursue common specific objectives should be speeded up; some object. But the movement was apparent in all eleven CSSE sites, and from questionnaire returns from all fifty states. It is a movement well integrated with the movement toward a fundamentalist (basics) curriculum.

Uniformity. In our interviews we asked about the desirability of having each school district, or each classroom, or each child, work toward being the mirror image of each other. Of course our respondents found the idea abhorrent. (Cloning is so objectionable that it has worked its way well into American humor.) But we were surprised that so many espoused these lists of common goals and urged a greater uniformity of instruction. Of course, it does not mean that they really want uniformity, perhaps only less diversity than they see around them now. Nor did they apparently mean they want uniform standards when they said they wanted more uniform standards.

It is obvious that the language a person uses or the knowledge a person has may be quite acceptable for one circumstance or one locality and unacceptable for another. As they grow up, even in a mobile world, most learners tend to move in limited circles, circumstances and localities, infrequently crossing over to where a different language-competence or knowledge-store is demanded. It is easy to see that whatever is a "minimum" competence in one life-space may not be in another. Actual norms or standards in arithmetic ability, reading ability, and knowledge of science specifics vary tremendously from person to person. We know this from our experience, and we confirmed it as we talked to lay and professional persons across the country.

How then is it possible for parents and teachers in our middle eastern seaboard community to state so fervently and unequivocally that we need to make the curriculum more uniform from school to school, from classroom to classroom--so that all children are learning much the same and are more nearly alike in their readiness to encounter new learnings? One of our team visitors to that site, curriculum specialist Fred Rodgers reported back:

> Another factor in the improvement of teaching quality is related to establishing what teachers and learners should accomplish as a result of their efforts. While most participants agreed that accomplishments should be broader than narrow specific behaviors and outcomes, they felt that working toward some known and acceptable objectives was helpful and needed. Without such a specification of objectives, most participants felt that it would be infinitly more difficult improving the quality of teaching . . . and institutionalizing expectations (Site visit report).

A principal of an URBANVILLE school was entirely in sympathy, citing lack of uniformity as the number one problem to be worked on.

Scenario T. A feeling that there should be better articulation of goals, prerequisites, and course activities was apparent in all our eleven sites. We prepared the following scenario to explore the issues discussed in this chapter in the communities of our national sample. We presented the following scenario to high school principals, elementary school science supervisors, and parents of high school seniors.

Scenario T

Please consider the following "correspondence"

Dear District Administrators,
The PTA-Council is thinking that it would like to set the theme for next year's meetings as something like "Putting the Curriculum in Uniform." We want to stress the need for uniformity of teaching across the district and the need for encouraging learning that leads to good employment opportunities. Please let me know your reaction to this tentative choice.
Respectfully, Willa Petrun, President

Dear Mrs. Petrun,
You will be hearing from others on the staff. For myself, I am pleased with your choice. Discussion of this theme will help draw attention to our objectives-based curriculum and the importance of providing equal opportunity for learning in each of our schools. If we are going to be fair, we must be uniform.
Sincerely, Jarvis Shattuck, Superintendent

Dear Willa,
I look forward to working further with the Council. I think the title, "Putting the Curriculum in Uniform," is corny and hope you find a better one, even if the topic is "uniformity."

I am disappointed, I must admit, that you did not choose the theme sponsored by Mr. Perez, "Where is our Science Program?" I feel that more emphasis on uniformity is going to further erode support for our college-prep program. We have lost support from the Board because we do not have their endorsement on a set of objectives for the sciences. They don't fund what we don't specify. I hope that the Council will give Mr. Perez's proposal further review.
Your "favorite" science teacher, Foster

Dear Ms. Petrun:
Thank you for giving us the opportunity to influence your consideration of themes for next year. In as much as the state legislature will be voting on bills to create a Competency-Based Diploma, I think we should review our entire philosophy of curricular uniformity in the district.

Uniformity could be an obstacle to providing an educational program tailored to each student's home-culture, talents, and aspirations. Uniformity could diminish the flexibility we have had in our alternative school and our magnet school. We should be discussing uniformity this year, and of course, we should recognize that too much of it can be as troublesome as too little.
Yours truly, Mavis Cooper, Principal, Central School

Scenario T continued

1. These letters summarize some of the concern about the curriculum. Some people are wanting courses to be more uniform, so that, for example, all sixth grade math courses and all American history courses are alike. What do you think about it?

of 53 High sch Principals	of 129 El Sci Supv's	of 138 Parents	
23%	21%	41%	___I think that much more uniformity is needed
45%	45%	41%	___I am opposed to a high degree of uniformity
19%	22%	14%	___I would like more uniformity, but getting it will cause problems too
13%	12%	4%	___Other: (please explain):

2. Superintendent Shattuck implied that the same courses in different schools have to be alike if the school system is to be fair. Do you believe this is so?

Our responding high school principals, in a ratio of about 3 to 1, responded "No," adding such comments as

> *"Backgrounds (ethnic, economical, political, etc.) are not all equal. Maybe more emphasis on "water" courses in Hawaii, (something else) in Idaho."*
>
> *"I believe this ignores the reality of what education is and the reality of rapid change in our time."*
>
> *"Someone has said that equal opportunity for unequals is not equality. No, I know that these courses should not be alike."*
>
> *"Basically yes. Methods may vary, but course content should be essentially alike."*

People having responsibility for coordinating the science curricula in elementary schools, in a ratio of about 3 to 2, also responded "No," adding such comments as:

> *"No, individual differences can be rectified by using competency based objectives for each school."*
>
> *"Yes, if the different schools are part of a large unit, e.g., the schools of Cleveland, then they should have uniformity."*

Scenario T continued

However, to the contrary, parents of seniors, in a ratio of about 3 to 2, responded, "Yes," adding such comments as:

> *"The only difficulty is when a student transfers from one school to another. The curriculum should be uniformly based with the same text--but classes should be tailored to student needs, not alike--still, two junior highs feeding the same high school should have a similar curriculum."*
>
> *"I do wish all the school systems were taught on the same level."*
>
> *"Not at all. 'Fair' should not be an objective of a school system or a curriculum. Educated graduates should be the objective."*

3. In your own community, generally speaking, ...
...how large a voice do parents have in school goals:

Of high school principals	35% said "large";	59% said "small";	4% said "none"
Of science supervisors	36% said "large";	58% said "small";	5% said "none"
Of parents of seniors	24% said "large";	66% said "small";	10% said "none"

...do school officials respond as these three did here?

Of high school principals	60% said "yes";	23% said "no";	17% said "don't know"
Of science supervisors	54% said "yes";	21% said "no";	25% said "don't know"
Of parents of seniors	32% said "yes";	20% said "no";	48% said "don't know"

...do most parents want more "uniformity" across schools?

Of high school principals	50% said "yes";	17% said "no";	31% said "don't know"
Of science supervisors	55% said "yes";	13% said "no";	33% said "don't know"
Of parents of seniors	39% said "yes";	13% said "no";	47% said "don't know"

4. Do you agree with the concerns Mavis Cooper raised with regard to "uniformity?"

Of 52 high school principals	89% said "yes";	8% said "no";	4% said "other"
Of 130 science supervisors	80% said "yes";	17% said "no";	3% said "other"
Of 137 parents of seniors	66% said "yes";	25% said "no";	9% said "other"

Scenario T continued

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5. Foster seems also to be suggesting that the science curriculum is competing with the objectives-based curriculum--rather than being supported by it. Do you feel that funding for the one, if spent properly, would support the other? Or do you feel that districts just have to make hard choices between traditional and objectives-based studies?

of 47 High Sch Principals	of 126 El Sci Supv's	of 123 Parents	
13%	9%	43%	...The methods and goals of traditional and objectives-based curricula are relatively independent; therefore, they compete for funds.
81%	86%	53%	...The methods and goals of traditional and objectives-based curricula are highly related; therefore, they do not really compete for funds.
6%	6%	4%	...Other (please indicate):

6. Do you agree with Willa Petrun that schools should give more emphasis to studies that lead to employment opportunities?

Of 52 high school principals	77% said "yes";	13% said "no";	8% said "I don't know"
Of 129 science supervisors	68% said "yes";	23% said "no";	9% said "I don't know"
Of 134 parents of seniors	80% said "yes";	16% said "no";	4% said "I don't know"

(The original sample sizes were: 87 high school principals, 210 elementary science supervisors, and 250 parents of seniors. The percents reported for Scenario T are unweighted percents of persons responding. Standard errors are not available.)

Vertical and Horizontal Articulation. As detailed on page 5:27 site visitor Howard Levine saw the URBANVILLE schools as having

> absolutely no articulation between the three major grade units (K-6, 7-9, 10-12) and very little articulation between classes within a unit.

Curriculum coordinators, facing the difficulties described on p 15:12, often try to get firm commitments from teachers at successive grade levels to improve the sequencing of courses, i.e., to get the curriculum better articulated vertically. Teachers agree, when asked directly, as shown in the following responses to one of our survey questions:

Here is a common claim:

> Students would get a better education if there were regular discussions and firm curricular arrangements between teachers at different grade levels.

Percent of people agreeing with the claim:

	Large city >100,000	Large Suburban	Non-Metro <100,000	TOTAL	Number Responding
___Teachers	83%	70%	72%	75%	177
___Curric Supr's	96%	88%	96%	93%	238
___Administrators	76%	77%	68%	60%	77
___Students	64%	60%	69%	66%	248
___Parents	83%	79%	68%	75%	140

	West	Midwest	South	Northeast
___Teachers				
___Curric Supr's				
___Administrators				
___Students				
___Parents				

Standard errors are not available for these weighted percents.

And the response of a high school teacher at BRT is typical (p 4:9):

> *It's really helpful to find students coming to class prepared for science by their past experience. Mr. O (the junior high science teacher) and I meet as often as we can. At the end of some teacher-workshop days we get together. We've worked a lot with chemicals and such 'cause a lot of things he doesn't have. So we share back and forth. This is all informal.*
>
> *But a few years ago when the state superintendent required all the schools to prepare objectives, we met frequently. This forced us to look at what we were doing. We tried not to be so repetitious. That's when we decided to offer some semester classes--botany and zoology, and to not require biology; because they get quite a bit of biological background in junior high. I've tried to encourage more of the students to take chemistry because Mr. O doesn't cover that as heavily.*
>
> *The primary people were also involved, but most of them don't do too much with science. Some do more than others. There's a lot more important things the primary grades must do. At least once a year, though, we try to get each primary class down here to the*

> *science rooms. I set something up for them to do. One year we had two living frogs that we tried to let the kids feel and touch. I couldn't hold on to them and we had frogs going all over. The kids thought it was great.*

In URBANVILLE and everywhere we heard the traditional complaint:

> High schools say that junior high schools do not prepare students, the junior high schools complain that the elementary schools do not prepare the students and the elementary schools complain about parents.

With such longing for better preparation it seemed natural to expect teachers to be spending regular time and effort to coordinate their work with teachers above and below them in the sequence. They didn't. Partly, they said, it was a matter of time, but also a disappointment with the results of such efforts. They were quick to point out that teachers at other levels were not sympathetic to the job they had at their level, as another URBANVILLE teacher told a site visitor:

> *...the high school science teachers have asked why the junior high science program does not prepare students in specific areas. We get upset and say, "Don't dictate to us what we are doing down here."*

What seemed so natural to almost everyone is to get widespread agreement as to the goals at each level and to allow freedom for each teacher to attain those goals. The same teacher went on to say:

> *I'd feel very tolerant towards a structured curriculum if it were appropriate to balanced basic-education. Structured goals, nationwide, K-12, but leaving it open to each teacher to use his creativity in developing and meeting these objectives, and enough resources, tapes, films, film strips, speakers, exchanging ideas--it would be fantastic. It's also important to have a nationwide testing program (not competitively based). Then we'd have some continuity.*

Many teachers seemed to underemphasize the pressures that could arise to remove teacher creativity and options when the test results were not satisfactory.

Articulation does not require detailed specification of objectives. Visiting a bustling Outdoor Education program at one of our CSSE sites, science education professor Clifford Anastasiou said:

> [This environmental education program] is perhaps the ideal example of articulation in the school district. All levels are represented on the planning committee. Even non-district consultants sit in with the Environmental Education Steering Committee. The thread is complete and its results are evident.
>
> [Elsewhere in the district] the problem of articulation represented itself immediately with the complaints, not only of teachers, but also the students. While at least one junior high teacher was concerned with the preparation provided by the elementary program, the students were almost unanimous in decrying the lack of basics in their elementary math program. At least one student placed the blame

> squarely on the IPI program, which in his view did not provide opportunities for drill on the basics of addition, subtraction, multiplication, and division.

It seems easy to blame lack of articulation for failure of instruction; it presumes that the teachers are teaching something, but the wrong things, and it presumes that the students can learn and go on to an education-enriched life. One cannot read these case studies, however, and conclude that organizational rearrangements will remedy the problem. Consider the words of a teacher trainee working in the math department of our high school in GREATER BOSTON (p 11:16).

> *I came here thinking that Trig would be the course where I would really be teaching Math, but I find the students have such a poor background in Math that I'm really not teaching Math at all. When students don't know how to multiply fractions there seems little point in going on with cosines and tangents, so much of the time I am doing basic Math with them, even though the course is called Trig.*
>
> *I worry about the long term consequences of doing that, but the subject is fundamentally sequential. There's no point in going on until you have mastered each stage. I've tried individualizing things for the students so that those who are ready can move on, but it soon gets very complicated, and I feel from the teaching point of view I need to keep them together as a class as much as I can.*

What have those youngsters been doing in all their pre-Trig math classes? It seems farfetched to blame lack of articulation, or errant teachers, or new math. The remedy must be more fundamental. Could it be that our own expectations of education, particularly in the urban school, are part of the problem? Could we be emphasizing preparation too much, rather than too little? We asked 198 elementary school math supervisors and 150 junior high math teachers about their beliefs about the emphasis on "preparation." (111 supervisors and 79 teachers responded.)

Most seventh grade teachers are disappointed with the skills and knowledge children have when they arrive in September, finding them not ready for seventh grade lessons, needing relearning or even new learnings to get them ready. And so with the sixth grade teacher, and the fifth, and so on down. Is this not so?

> 85% of elementary math supervisors said, "This is the way it is."
> 70% of our junior high math teachers said, "This is the way it is."

Most teachers assume that it is their responsibility to get children ready for the lessons of subsequent years. Is this not true?

> 79% of our elementary math supervisors said, "It is true."
> 82% of our junior high math teachers said, "It is true."

But, examining their own lessons, the projects they assign and the learning experiences their pupils are having, many teachers recognize that they have much broader aims than just getting the youngsters ready for next year's learnings. It distresses them to think of diminishing the broader aims in order to spend more time on the particular skills and knowledge the next teacher may require. Is this not so?

> 63% of our elementary math supervisors said, "That is the way it is."
> 44% of our junior high math teachers said, "That is the way it is."

How do you feel? Should most math teachers reconsider the lessons, the projects, and the experiences in their own class toward the purpose of getting youngsters better prepared for the lessons of the next year?

> 41% of our elementary math supervisors said, "Yes, definitely."
> but 49% of them said, "No, the broader aims are important too."
>
> 51% of our junior high math teachers said, "Yes, definitely."
> but 34% of them said, "No, the broader aims are important too."

Percents are unweighted percents of those responding. Standard errors are not available.

From marginal comments and from our interviews we know that many respondents want to say, "do both." But something has to give. The teachers are not "goofing off." Most would be doing more of both if they could. Right now they feel that a more focused, more basic-skills-oriented curriculum, well specified and articulated, would help. Yet we see problems wherever a district or state has tried to institute a more structured, a more regimented instructional system. There seems little promise in that popular answer. After taking a look in the next chapter at the student's learning, we will come back to these classroom problems with greater attention as to what the teacher was doing with learners who were in difficulty.

And a few more words about sequencing. There probably are optimal sequences for teaching many things, and the optimal paths are probably about what teachers and instructional analysts tell us; but the sense of marked difference (that a few of them have) that it makes to follow one sequence rather than another is not based on evidence that is apparent to us. It is reasonable to suppose that some of their conviction about "the best path" is based upon their own great distress at failing now to teach learners what earlier or elsewhere seemed relatively easy to teach. It is not a sure thing that these children, with the present learning environment, would be learning better now if they had a different sequence of lessons.

A curriculum could become more tightly sequenced and non-redundant than it should be. Students move from school to school and from city to city. They become sick and go on vacations, they skip school. They need to become familiar with redundancy, misalliance, and contradiction--one perfectly coordinated course of study with a single textbook series might not be ideal. We in the USA are not in danger of getting that much articulation and uniformity, but we may be in danger of putting too many hopes in that direction. Almost no place did we hear that there is a problem because students cannot go from one set of text materials to another. The complexities of sequencing are many, such as in the ALTE elementary school social studies program, where a curriculum committee chairperson told us:

> *As can be seen by comparison of the Social Studies Committee's Chart and School A's chart, that school is using one of the recommended programs at every grade level [Allyn and Bacon: kindergarten, 1; Holt: grades 2,3,4, and 6; MACOS: grade 5]. There appears to be no problem in organization or sequencing (p 3:32).*

In this suburban midwestern site we did not find a strong pleading for better articulation, vertically or horizontally. The high scholastic-aptitude children, as all children, had not learned all that their teachers felt they should, but as they entered a new grade they learned what they needed so quickly that it did not become an issue. The three prime subject matters in the high school, science, math and history had in fact been greatly articulated with sequential prerequisites.

In this site, there was perhaps extra pressure on the teacher to be a "strong teacher." This meant knowing the subject matter, knowing how to teach it to particular groups, being highly motivated, engaging the students and having a strong personality. The pressure was on the teacher to do better on tests oriented to college admissions, not on basic skills tests--so the teacher martialled his/her efforts at being collegiate and individualistic--and not spending very much time on what some are calling the "minimum competencies."

Lou Smith, our observer there, found that the objectives teachers pursued in this program were identified in terms of student excellence rather than minimum competence--and the difference was much more than two separate points on a scale.

> One cannot be around the ALTE District very long without running into comments about "academic excellence." As a value, purpose, goal, objective, it provides a perspective on the entire system, yet at the same time, it harbors some interesting implications. It doesn't sound like or carry the usual connotations of, the language of behavioral objectives that the educational psychologists and learning theorists are fond of citing. Nor does it convey the flavor of the management-by-objectives school of thought in educational administration. Rather it seems a mix, a corruption perhaps, of a humanistic stance of "knowledge for its own sake" and "learning as a social mechanism." (p 3:40)

But such was the exception.

COMPETENCY-BASED EDUCATION

In almost all the other CSSE sites there has been an effort to redefine the curriculum in terms of student "competencies." As indicated in the previous chapter, it was only recently that the aims of schools were expressed in terms of abilities and competence. The language of goals has depended on who has been doing the talking. The philosophers have their language, the employers theirs, the teachers theirs, the liberal arts professors theirs. These goals now are in the languages of the behavioral psychologists or psychometricians, who speak of tasks to be accomplished and traits to be developed. They have emphasized that it is useful to talk that way because such things can be measured, tested. They sometimes acknowledge that the objectives can get changed in the transformation from one language to another, but often for the better, and that it is the operationalization of student behaviors that permits us to develop a technology of education.

To be sure, there have been emphases on performance, on testing, on skills, on tasks, since early times. Comenius, Pestalozzi and Herbart thought along those lines.

What is often considered the first educational research study was a study of spelling skills.* Just after World War II the National Council for the Teaching of Mathematics advocated expansion of curricula for all children to include twenty-nine specific "competencies." The programmed instruction movement featured individually-paced questions designed to gradually strengthen the habits needed by a learner to respond with particular answers to particular questions. The orientation to student competence has long been a part of teaching, but only recently has it been a nationwide conceptual base for organizing the curriculum.

Among the things that are being emphasized as competencies are: reading, arithmetical computation, map-reading, placing a mail order for merchandise, recognition of correct word associations and grammatical constructions. Among the things not included are: writing composition, constructing an argument, making a proof, listening with comprehension, oral discourse, and complex knowledge in all academic disciplines. The idea is strong in the country today that youngsters are so poor at the basic skills that they should devote almost all their attention to getting ready to learn the important things.

It is felt by some that employers are not hiring young people because they are not sufficiently competent. In an Associated Press story (early November, 1977) by staff writer Martin Crutsinger, Florida State Education Commissioner Ralph Turlington was quoted as saying:

> *I tell 11th graders that they are lucky [to be taking these new tests]. For the first time, they will be able to show a prospective employer a diploma that is proof they can read and do arithmetic. What is included in the test are things we all need to be able to do in our every day lives.*

Our CSSE studies across the country have uncovered no evidence that employers want such information from the graduate. They already have better ways of finding out how suitable the youngster is for the work they have. This is not to say that the employers are indifferent to the quality of education youngsters get in school. (For the most part, youngsters are better educated than needed for many of the jobs open to them, e.g., supermarket baggers, parking lot attendants, life guards. The difficulty youngsters have getting jobs is much more because principal wage-earners are "moonlighting" and still more housewives are competing for jobs, trying to make ends meet--not because the youngsters lack the education to do the work.)

The assessment tests in Florida and elsewhere are not directed at the things that people do in their everyday lives any more than the previous school lessons were. These tests have not been validated as measures of education nor as bases for diagnosing individual or district-wide learning problems. They have been built upon a carefully gathered set of intuitions, shaped by test developers and committees of educators and lay people. There seems little reason to expect more from the newer editions than we have been getting from the National Assessment of Educational Progress and earlier state assessment batteries, such as the Michigan Assessment Tests,* which have few supporters other than their sponsors.

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*J.M. Rice, "The futility of the spelling grind," Forum 23 (1897): 163-72. and 409-19.

As best we can tell, the two reasons we have "competencies" and "performance tests" now appear to be to provide teachers with a more concrete and limited set of obligations and to provide administrators with concrete information about student learning. Teachers have had in the past and will continue to have ample and higher quality information about student learning, but it is partly tacit knowledge, informally gathered, and they cannot share it effectively with school officials and the public. Now, with a transformation of school responsibility toward the development of competence, both reasons look good and circumstances appear amenable to using instructional technology. But whether or not the management information can be put to good use remains a question. Poor learning and poor teaching will probably continue to be a problem where it has been a problem in the past.

Yet enthusiam for competency based education and proficiency testing seems to grow. In ARCHIPOLIS

> the district science supervisor lamented the steady deemphasis of academic subject matter in recent years, . . .but he felt "it had bottomed out." Now he was optimistic that the Competency-Based Instructional Program would regenerate support for science, math, and social science.

And in San Francisco late in 1977 HEW Secretary Joseph A. Califano, Jr. said:

> *In short, basic competency tests, used skillfully and sensitively, are useful and necessary. They are a limited, but very important tool for charting and improving the process of education. We need to do more testing and we need to do better testing.*

In our visits to eleven districts around the country we found considerable evidence of "more testing" but, except for personnel in charge of testing, we found few to testify that testing was useful to them and no knowledge of any district or school which had substantially improved its educational system by moving to a competency based educational program.

Hierarchies of Learning. One of the attractive features of a task analytic or competency-based approach to instruction is that certain skills and tasks become obviously prerequisite to others. In order to do long division it is necessary to subtract; in order to understand the Civil War it is necessary to understand the geography of the Atlantic seaboard; in order to teach PSSC it is necessary to check out math skills:

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*See Ernest R. House, Wendell Rivers, and Daniel L. Stufflebeam, "An Assessment of the Michigan Accountability System," Phi Delta Kappan, 55 (June 1974): 663-669; and Jerome T. Murphy, and David K. Cohen, "Accountability in Education: The Michigan Experience," The Public Interest, No. 36, (Summer 1974): 53-81.

> Paul indicated that sophomore science instructors were asked to recommend students, but he noted, "Actually, James and I are more concerned about math competency than about their references . . . (VORTEX, p 10:9)

The task of curriculum development and teaching, then, is one of identifying the most important foundational skills and building upon them. As anthropologist Jacquie Hill-Burnett observed in ARCHIPOLIS (p 9:5.)

> Many, but not all, junior high school social studies and most senior high school social studies teachers regard reading skill as necessarily prior to learning social studies.

But elementary teachers there challenged the notion that reading skill should be fully developed before introducing substantive learnings. Dr. Hill-Burnett quoted them as saying:

> *. . . teaching children to read is a never-ending process. Children don't just learn to read for all subjects for all times (p 9:5.)*

and found them dismayed at high school teachers who seldom seemed to work at teaching youngsters to read new content areas.*

As we listened to and read the formal rhetoric of the school about the essentiality of reading and other readiness skills we wondered if teachers would tend to postpone analysis and interpretation of ideas right out of the school curriculum. We were reassured somewhat by the responses to a survey question asking about whether it is best to teach reading skills and math facts alone at first, along with lots of basic information, or even at the same time teaching analysis and interpretation. The model response for elementary school principals and social studies supervisors was to teach all those things together, though high school math teachers overwhelmingly said, "Teach the basic reading and math at first, the other things later." (For a more complete display of the results see Item U10 of Scenario U in Chapter 18,)

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*In a presentation at the Annual Meeting of the National Council of Social Studies in November 1964, a member of the Johns Hopkins University project staff engaged in a study of American high schools suggested that "both a ceiling and a floor" were present in secondary school expectations. "If the pupil cannot read at a certain level by ninth grade, there will be little 'outreach' assistance extended to him," the researcher declared, "because high school instructors assume a basic reading competency exists. On the other hand," he continued, "outstanding students usually encounter a top-level or ceiling effect beyond which their efforts cannot take them."

One is reminded of a recent warning by John C. Glidewell that "education for contemporary life may require more deviancy than schools can tolerate," in "New Psychosocial Competence, Social Change and Tension Management," p 104, in Research Contributions from Psychology to Community Mental Health, Jerry W. Carter, Jr. ed. (New York: Behavioral Publications Inc., 1968).

The criticality of learning sequences has been alluded to also in a previous section. There is little agreement at present as to the advantage of one sequence over another, and even as to the general organizational value of a hierarchical approach. An obvious risk is that too much emphasis will be given to mastering general skills, delaying too long the study of systemic content such as "homeostatic life-sustaining systems" and "demographic changes related to land-use."

> As part of our CSSE national survey we asked junior high school teachers:
>
> Please indicate whether you agree or disagree with the following statements:
>
> > What students must learn first when they begin to study science is vocabulary. They do not at first need to understand the reasons scientists study this and not that--nor the reasons scientists use this method and not that method. The learner of science must go through stages--first the language, second the concepts, then the scientific method, and finally an appreciation develops.

Among the comments from teachers who agreed were:

> *I strongly agree. The vast majority of my students know very little scientific language and are not really capable of understanding most concepts until their related vocabulary words are first covered.*
> *(a South Carolina sixth grade teacher)*
>
> *A view to methodology is important from the outset although the focus is not there to begin with. The student should have some "hints" as to the association between vocabulary and method.*
> *(a Missouri teacher of Afro-History & Psychology)*

and among the comments from teachers who disagreed were:

> *I do not think anyone learns in "stages" as teachers plan them. We know human beings mature at different rates with certain kinds of mental activities becoming possible at different age ranges, but it seems silly to speak of learning language, then concepts, then method. Science, any kind of systematic thinking, is hard to break down into L-C-M stages. Concepts, the mental images we develop, grow with experience--usually best with the most concrete experiences--so our goal must be to facilitate concept formation. The major concept we should build is "science"--what it is--that "art of science" should be the subject of our teaching--language, concepts, and methods from the start.*
> *(a New York 9th grade sociology teacher)*
>
> *Students should learn the way of scientists by the discovery method, experimenting and learning vocabulary along with experimentation. To learn the way of the scientist the students should experience the ways of scientific discovery in the classroom.*
> *(a New Jersey teacher of grades 6, 7, & 8)*

Too few of the 75 teachers sampled responded to justify presenting a tally.

Mastery Learning.* Another part of the technologizing of instruction is the prespecification of the degree of mastery of a task to be assured before passing to a subsequent learning task. Among many instructional technologists is the belief that a general figure can be set, such as 95% mastery for individualized instruction or 90% mastery for 90% of the students for group instruction. In many places we found teachers referring to these standards as logical and desirable, but except with the packaged instructional systems we found few instances of teachers working with the mastery concept. (We did recall the research of Ulf Lundgren of Sweden who found teachers informally and even unconsciously attending to a "steering group" of students at about the first quartile to get information as to when to review further and when to pass on to another study-unit.)

In RIVER ACRES (p 1:78)

> The district [has just] initiated a minimum competence check in reading comprehension and mathematics for its seniors in response to Texas regulations.

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*Benjamin S. Bloom has voiced and illustrated the Bruner-Skinner paean that every child can learn anything, only differing in time-to-learn. Under the label of mastery learning, he has claimed that if tasks are appropriately specified and feedback rigorously obtained, the differences between students in time-to-learn can be reduced sufficiently to justify the school's setting common requirements or "minimum proficiencies" for all learners, and can further sustain the teaching long enough to increase retention to a point that would justify the label "mastery." Bloom has stressed the use of formative evaluation testing (his definition, not Scriven's) to catch student performance errors before they can be compounded.

It is apparent that a mastery learning approach will be most adaptable to instructional tasks that are widely useful, that lend themselves to specification and testing, in a classroom where the uniqueness of personal understanding and those learnings that come with high-above-minimum proficiency (implications, nuances, further relationships, probably including the comprehension of many of the more difficult science concepts) are to be given lower priority. These "mastery learning conditions" are attractive to many people seeking a greater emphasis on basic skills and knowledge. (See Benjamin S. Bloom, "Introduction to Mastery Learning and Theory," edited by James H. Block, Schools, Society, and Mastery Learning, New York: Holt, Rinehart and Winston, Inc., 1974. For critiques of mastery learning see the chapters by James Block and William G. Spady in the same volume.)

We wanted to compare several perceived needs for improvement of curricular programs in the schools. So we asked three groups of professional educators to indicate the attention needed in the present curriculum in your school:

	Needs more attention	Needs less attention	Amount of attention about right
Teaching of "prerequisite skills"	____	____	____
Specification of course objectives	____	____	____
Emphasis on abstract concepts, ideas	____	____	____
Emphasis on facts, rules, techniques	____	____	____
Setting minimum proficiency levels	____	____	____

Scoring each response +100 for "needs more attention," -100 for "needs less attention," and 0 for "amount of attention about right" we got scale values* as follows:

	from 55 Elementary School Principals	from 145 Gr. 7-12 Social Studies Supervisors	from 94 Gr. 10-12 Math Teachers
Teaching of "prerequisite skills"	+24	+66	+75
Specification of course objectives	+29	+53	+11
Emphasis on abstract concepts, ideas	+18	+18	+17
Emphasis on facts, rules, techniques	+10	+ 2	+30
Setting minimum proficiency levels	+36	+66	+77

It is clear that all of the three groups felt that setting minimum proficiency levels is one of the more important things to do in improving the curriculum. Unfortunately the groups indicated that all five things need more rather than less attention--which is difficult to do in an already busy classroom.

We noted earlier that one way of setting minimum scores is in terms of minimum proficiency for high school graduation. In the past school was usually seen as providing an opportunity to take courses. A student learned various things there. The teachers really did not know what all they learned, and what they would remember, and how it would influence them. They knew pretty well who the good students and the poor students were. They sometimes had to write references to employers or college admissions offices, and in a more or less confidential way, they spoke of a youngster's competence. But they did not make public acknowledgement of a student's inability or disinterest in schooling, by withholding a diploma.

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*These scale values are theoretical medians. If all respondents had said "needs more attention" the scale value would be +100. If all said "needs less attention" the scale value would be -100. A scale value near zero means that the numbers saying "needs more" and "needs less" are about the same.

Passing from grade to grade was considered automatic, a "social promotion," not acknowledgement of competence. Awarding the diploma was also a social promotion.

Although the high school diploma has not (at least in this century) been a certificate of merit, various citizens, elected officials and educators, in their dismay about the incompetence of some graduates have implied it has been. Nevertheless, there may be merit in their proposal to have a proficiency diploma, perhaps authenticated successful test performance, such as a seventy percent correct response on the Functional Literacy Test developed by the State of Florida. Admiral Hyman Rickover and a few others have advocated a national testing as a basis for awarding the high school diploma.

We found relatively little interest in this matter in the eleven districts we visited. In VORTEX and URBANVILLE there were examinations that had to be passed prior to graduation but one had several opportunities to pass the test, and remedial courses if needed.

To check on the concerns about high school graduation requirements more broadly across the country we asked our survey respondents two questions, one general and one specific to science competency.

Should all high school students in the United States be required to pass a standard examination in order to get a high school diploma?
___Yes, they should ___No, they should not ___I don't know

	Large City >100,000		Large Suburban		Non-Metro <100,000		TOTAL		Number Responding
	Yes	No	Yes	No	Yes	No	Yes	No	
___ Teachers	75%	10%	58%	31%	61%	22%	66%	19%	172
___ Curric Supr's	86%	9%	48%	21%	38%	53%	56%	36%	219
___ Administrators	33%	16%	6%	94%	34%	45%	42%	40%	74
___ Students	53%	33%	38%	40%	78%	17%	54%	33%	241
___ Parents	55%	45%	18%	79%	79%	17%	69%	27%	124

Should school districts require some minimum competency level in science for all students to attain in order to graduate from high school?

___Yes, they should ___No, they should not ___I don't know

	West		Midwest		South		Northeast		TOTAL		Number Responding
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
___ Teachers	94%	4%	41%	36%	59%	17%	80%	6%	67%	17%	170
___ Curric Supr's	52%	42%	47%	39%	77%	18%	87%	10%	70%	23%	223
___ Administrators	50%	15%	27%	34%	52%	35%	4%	96%	37%	37%	73
___ Students	51%	40%	26%	64%	50%	32%	60%	35%	46%	40%	236
___ Parents	57%	29%	59%	40%	68%	25%	64%	35%	67%	30%	123

Standard errors are not available for these percents.

Our results were not unlike those of George Gallup who found among citizens 65% favoring such a requirement for graduation.*

In summary, with regard to pluralism and uniformity, across the country, in school and out, we found a concern about teaching and learning. The pluralism of our communities seemed to hold back teaching and learning. Making the curriculum more uniform seemed to be a way to go.

We noted particularly a considerable difference between the national concern and the local concern. The national concerns are expressed in the popular press--it tells of test score archives, poor reading and writing, suits filed by non-reading graduates, hostility and misconduct in classrooms, problems with busing, etc. The problems seen locally are less sensational, more pervasive. In talking with teachers, students and parents one hears about bored students; absenteeism; parents who support the student rather than the teacher, or don't support either one; poor reading and writing, uniformity and articulation, overly large classes, heterogeneous classes, and so on. The problems are related and overlap, but a direct attack on the national problems seems not too likely to help the individual teacher who has trouble teaching a heterogeneous class and the individual learner who has trouble learning those things now being designated as "essential."

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*George H. Gallup, "Eighth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools," *Phi Delta Kappan* 58 (Oct. 1976): 199.

Chapter 15

STUDENT LEARNING

As we talked to people in the schools we found them ready to discuss three aspects of student involvement in schooling:

experience

performance

motivation

Topics such as aptitudes, misbehavior, personality, and emotions, though related of course, seemed less likely to sustain a conversation. The teachers saw motivation as a matter of great importance, one that appeared to be a major obstacle for individual and group learning in many classrooms. We devote a section of this report to the topic beginning on p 15.

Student performance seemed to be a topic of increasing interest, although we know that teachers have been talking for many years about how well youngsters do in recitation, on tests, and in getting ready for subsequent courses. In matters of student experience the talk continued--as we believe it has for many years--to be centered on the courses a student is presently enrolled in, and what books, what topics, and what teachers he or she has had a chance to be exposed to.

It seemed natural to us to expect a conversation to shift easily from "experience" to "performance"--but we seldom found that it did. Somehow, when we were talking about experience, there seemed to be little talk about what the specific results of that learning opportunity were. And when they were talking about student performance there seemed to be relatively little attention to what sort of a situation it was that brought about that pattern of responses. We know that many researchers and others--whether disciples of Professor Skinner or not--are quick to link together the stimulus conditions with the response behavior. We seldom found a rhetorical linkage between experience and performance in the schools we visited.

Some of our colleagues say that this points to the very trouble with instruction in the schools, that the teachers do not think in terms of causes and effects. We heard plenty of casual talk about causes and effects, but little explicit or rigorous. But rather than conclude that the teachers were falling short in matters of diagnosis and explanation we were inclined to conclude that the simple cause and effect statements that are the basis of research studies are seldom adequately descriptive of the conditions of learning and teaching in the classroom. It seemed to us that teachers were successful in efforts to develop an elaborate discussion of the conditions in which teaching was occurring, and to discuss some of the elaborate patterns of response--but neither they nor we had an adequate language and possibly not an adequate conceptual system for understanding why the children were learning or not learning*. (Even the descriptions of what they were learning were satisfying neither to us nor to the teachers.)

This was not apparently a sign of lack of concern on the part of teachers for their students--in fact they were impressive by their very concern. This somewhat compartmentalized thinking was not a condition that was true only of "weak" teachers, not true of the "strong." It was our conclusion that it was a general condition, that perhaps the teachers did not have a sufficiently complex and trustworthy conceptual system to encompass both the dynamics of the curricular arrangements and the dynamics of student comprehension. A good bit of our conclusion is speculation--what we were certain of is that the discussion of student experience and the discussion of student performance usually occurred separately.

It was not the purpose of this study to examine student experience or student performance.** We spent relatively small amounts of time observing and interviewing students. We found such cases as Rob Walker's description of Tom, a graduate (p 6:39) and Alan Peshkin's of Beth, a sophomore (p 4:19) helpful and insightful--but our attention usually was on the larger arrangements made for the teaching of science, math, and social studies. Therefore, there is little to report directly on student learning. What we will describe in the remainder of this chapter is more on the distinction we found between performance and experience, a lot on the role of testing as a provider of evidence of student performance, a just-promised section on student motivation, and a bit on how we saw racial and sex differences among students in the sites we visited.

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*Lee J. Cronbach. Beyond the Two Disciplines of Scientific Psychology, American Psychologist 30 (1975):116-127. Also in Gene V Glass, ed., Evaluation Studies: Review Annual, vol. 1, (Beverly Hills, California: Sage Publications, 1976.)

**The case in this study was defined as a high school and its feeder schools.

PERFORMANCE VERSUS EXPERIENCE*

We found it generally assumed that a good experience in the classroom leads to good performance. Simultaneously a student gains a skill at performing particular operations and an understanding of the implication of those operations, it is believed. Obviously it is possible to underemphasize either direct knowledge or tacit knowledge, either the manipulation or the broader meaning, but the grand belief is that if you teach well you will accomplish both.

What we also found in these eleven sites was a conviction that too little emphasis recently had been placed on the basic skills, particularly the mechanics of reading and computation, and that if the curriculum were properly invoked, if the obstacles to teaching were adroitly skirted, the result would be a satisfactory attainment of both performance and experience. There was little skepticism that a greater emphasis on the basic skills would result in even less attention to the kind of experience, topics, and conceptual associations that have been honored by classicists and reformers alike.

School practitioners and education professors, we observe, are inclined to disagree about the importance of many conceptual distinctions. This was one of them. Jerome Bruner and David Olson, for example, declared the view naive that one can substitute "instruction" for "learning through experience."** Are such professors splitting hairs, stressing the competition and even incompatibility between performance and experience?

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*This is not the same argument as the one teachers have about whether to emphasize content or skill. In that case, as explained by one of our Texas interviewees, one teacher might put it at one extreme, saying:

> *I'm teaching totally from a content perspective, [with] X amount of content I want the students to know at the end of the year,*

while a teacher at the opposite extreme says:

> *It is my goal to teach the students skills, and content is irrelevant. Those skills might be that the student would know how to vote (or) how to decide on an issue such as abortion.*

In both those cases the teacher is pursuing an outcome, some preparation to be acquired by the student, whether a skill, some knowledge, or perhaps attitudes. Any of these satisfy the argument favoring performance. None are explicitly aimed at giving the student "experience" itself, such as the experience of voting, the experience of making key decisions, or any experience deemed important in itself.

**Jerome S. Bruner and David R. Olson. "Learning Through Experience and Learning Through Media," in Communications Technology and Social Policy, ed. George Gerbner, Larry P. Gross, and William H. Melody (New York: John Wiley and Sons, 1975).

Are the teachers insensitive to the dangers of imbalance tipped one way or the other, resolving the issue not so much in terms of what youngsters can best use but as to what the public wants taught? Perhaps some of both. We found most teachers thinking that too much emphasis had recently been placed on discovery-learning, hands-on demonstrations, field study, and contemporary topics, and though some of those aims were quite defensible, time spent on them did not serve the learner sufficiently well as he/she moved another grade further in school.

The split among teachers was apparent too. It was quite apparent in ALTE where teachers at the alternative school held aims for their students quite different from those of the teachers at the regular school. (The full discussion of the alternative school at ALTE indicates a more complex story than this brief vignette; see p 3:104.)

> The mixed feelings of the ALTE faculty are attested to from a variety of sources. The high school curriculum guide, for instance, does not contain any reference to the "A" school; recruiting for the school does occur visibly (e.g., signs posted in the corridors) and is supported by the administration. Comments by teachers in committee meetings ("they are a part of ALTE High") carry a flavor of implicit separateness and/or exclusion. In return, the A school faculty sees itself as apart from, and sometimes hostile toward, the regular faculty. The Alternative School students are explicitly negative toward ALTE High School. The stuck-up youngsters, the boring curriculum, the domineering faculty, the punitive administration, and the general lack of freedom for doing one's own thing are recurring reactions in the school.
>
> . . .
>
> Secondly, much of the discussion and exchange of epithets with and about the A school seems beside the point, e.g., cop out, dropout, spaced out, and so forth vs. boring, regimented, authoritarian. The underlying fundamental issue, in this observer/analyst's speculative view, is that the A school represents a fundamental critique of the core values, (e.g., excellence as specialized knowledge) and the central procedures (e.g., high-demand, teacher-structured courses and classes) at ALTE High School, as well as of the relationship between that kind of school and the larger society of which the community of ALTE is representative.

Here the critique came from teachers, the alternative school teachers, and from students and parents associated with that school, and it was a critique of the orientation to performance learning by teachers who would be considered some of the most able science, math, and history teachers in the country.

In the 1960s when the "hands-on, messing about" curriculum projects were being developed and promoted, the sway seemed to be with those who advocated experience for the students. Now the pendulum swings back. In the URBANVILLE case study (p 5:16) Wayne Welch reported:

> Teachers who tried some of the newer curriculums have changed back.

And Rudy Serrano reported from WESTERN CITY (p 7:9):

> For various reasons the elementary schools appear to be giving up the service programs that numbers of them had established a few years earlier.

Further evidence of reorientation toward performance skills and away from conceptualized experience is found in the FALL RIVER case study (p 2:39) and in the ALTE case study (p 3:46.) A teacher in BRT summarized the present condition this way:

> *Now it seems, the shift is "back to the basics", like learning vocabulary and laws and problem solving more than technique. Lab technique is still important but there's all this worry about kids not doing well on the ACT and SAT. I look at the new texts that are coming out. They tend to be more organized, giving the student information and then expecting them to remember it. I'd say we've always been more traditional here than larger schools in the metropolitan area so I don't think parents were that much aware of a change back, but I get it from parents who are also faculty. You know, "my son or daughter didn't do well when they took the ACT," that sort of thing. And the students feel they didn't do well because they didn't know what the words on the exam meant. Especially in the science area. More traditional teaching of science would teach these words more effectively.*

One world scholar who has caught the eye of teachers (and the trainers of teachers) is Jean Piaget of Switzerland. Piaget has meticulously analyzed certain stages of cognitive development of youngsters. Apparently without his intending it and perhaps unfortunately, teachers have become persuaded that their teaching should concentrate on the levels youngsters have not yet attained. A teacher at one CSSE site complained:

> *The system (here) is not increasing the number of people who reach the level of formal operations. Those who do are achieving it on their own. It's at 25% and it should be 85%.*

There is no research evidence that the best thing to do for a child who is slow at reaching (or somehow prevented from reaching) a certain cognitive stage is to concentrate on attaining that stage. The predominant thinking of cognitive growth and education by consultants to schools these days apparently has been to identify deficits and teach for them directly rather than to proceed with what might be considered a well balanced set of experiences.

Stressing the importance of experience, a few teachers told us things like:

> *I would not object to carrying a biology class to my farrowing pens when sows had pigs because I could stand there in dirty clothes and teach one heck of a sight more in a few minutes than you can teach out of a book in a long time.*

and

> *If you can't have on-the-job training, where they're paid for it, then simulate it as close as you can. You can do a fair job in that shop, but you can do a much better job out of that shop. We have built buildings all over this county with our carpentry and masonry classes.*

Statistical analyst Beth Dawson, visiting our Pennsylvania site, reported on one open classroom middle school (see p 10:24):

> The opportunity to do, to experience, was frequently mentioned as one of the best qualities of this school's curriculum. . . . the school store incorporates a unique philosophy related to "learning through doing". . . a 7-minute closed circuit newscast goes daily to each classroom.

But these teachers and schools were exceptions. Some harassed teachers spoke wistfully of such activities. Most dismissed them as frivolous. Most were persuaded that it made much more sense for children to learn what others had already learned rather than to learn it tediously and discouragingly each by oneself, and this persuasion essentially excluded all instances of self-learning of key problems, ideas or experiences. In ARCHIPOLIS our observer was startled to hear the teacher ask, "How do we learn?" and the class chorus back "We learn by reading." (p 9:9)

We asked for the reasons for this shunning of experience-based curricula. At least two major factors seemed to be operating. The most deeply entrenched factor seemed to be a strong philosophical bias toward the authority of "book learning." As we conclude after careful review in Chapter 17 (on socialization) most teachers believe children should be "disciplined" to learn expeditiously from printed materials. (See the GREATER BOSTON case study, p 11:30, and the FALL RIVER case study, p 2:20.) Formal mathematics teaching in elementary school is necessary to prepare students for junior high school. (See the RIVER ACRES case study, p 1:37). A physics teacher in RIVER ACRES (p 1:152) commented,

> *Our whole science department is fed up with it [PSSC]. Investigation process wastes so much time. We end up telling them what they are looking for anyway; they cannot "pull it out."*

The other major factor in the movement away from an experience-based curriculum is that teachers who attempt to provide direct experience of the phenomena are often confronted with difficult and frustrating problems. One problem is a lack of training in arranging "experiences" in the difficult "real world." (See the VORTEX case study, p 10:16, and the FALL RIVER case study, p 2:39.)

Proper training, however, does not eliminate the frustration. Preparation for laboratories or other hands-on activities takes time to collect, organize, set-up, take-down, clean-up, and store the materials needed for doing the activities. Most teachers do not have the time. Two elementary teachers sought out a site visitor in FALL RIVER to tell him that they enjoyed teaching science using "hands-on" materials, but given all the other work that was demanded of them, they just could not afford to spend the preparation and class time that it required.

Learning by Experience. With or without regret few teachers are engaging students in learning by experience. Most accept the equivalence of learning by experience and learning through instructional media (mostly the printed page) and see the student as getting greater volume via the media because of the efficiency involved.

If there was any celebration of experience without performance goals in the case studies, it may be epitimized by Rob Walker's description of a presentation for children at the Museum of Science in GREATER BOSTON (p 11:28).

> The machinery is impressive: a sound synthesizer coupled to TV monitors, street size ultra-violet and sodium lamps, a double bank of colored lights some ten feet tall triggered by different sound frequencies, and a burglar alarm which detects movement by ultra sonics. (One volunteer comes on stage and has to creep up on a balloon and burst it without setting off the alarm. To help her she sees her movements graphed on a TV monitor. Then the monitor is switched off and the children have to shout directions to her from another monitor only they can see.)
>
> High frequency sounds show, to the children's delight, that they can hear things their teachers can't hear. "Just learn to talk in those sounds and you can talk all day in class without your teacher hearing you," suggests the programme presenter.

However, others may prefer Lou Smith's description of sixth graders on a week-long camping trip organized by the ALTE school district as a part of their outdoor education program. As Smith described it (the incident as more fully described starting on 3:51 is more informative than this brief excerpt):

> As we were roaring off on the van, going to the canoeing area, we went by a big turtle on the road. The driver stopped and one of the teachers got out and brought it into the van. It was going to be added to the collection. Later we found another. All on the way to canoeing. The kids were interested and played with the animal, watching it as it moved. . .

> While we were on the lake in the canoes, we spotted a number of water turtles with a much flatter back and body, sunning themselves on logs and stumps. In one spot there must have been a half dozen. The kids all paddled over to have a look. I was surprised that the turtles were not skittish. The kids got up quite close before they took off.

However, not many teachers appear to be very happy about devoting too much time to these sorts of experiences that are delightful but not directly productive of demonstrable learnings. They are considered very good for a change of pace, and one principal said he hoped all his teaching staff would get involved in the outdoor program because some of the children who did rather poorly in class were outstanding in the outdoor situation.

Students, as well as teachers and parents, know that natural unscholastic types of experiences should not dominate their learning. Tony, the accomplished science student in PINE CITY (p 6:31) did not belittle the role of the classroom.

> I asked Tony if he felt he could learn more about science by staying at home and exploring the woods and creeks. His answer, surprisingly, was no, a lot of science you couldn't learn from experience, at least in this part of the country. He felt science was not just about the immediate environment, but provided a window on a wider world. One of the things he liked about science was that it did provide some escape from the constraints of his limited world. He summed up his feelings saying: "Math is just a bunch of numbers, English is a bunch of words, but science is different. Science changes, you move on, you don't stay on one thing."

The Mystery of Learning and Forgetting. Even with the understanding that comes to teachers with experience, much that happened each day in classrooms had an air of mystery about it. Who knows how Harold managed to learn that skill? It is impossible to believe that Linda can no longer do "Sevens," but she cannot, and she says she never had them. A RIVER ACRES teacher put it this way (p 1:106):

> *When the light goes on for a kid I ask, "What did I just say? Tell me, so I can use it next period." It doesn't work next period of course. Today we were doing the expansion of binomials. We had done the usual background work on this. So I was giving them Pascal's triangle and some of them caught that rhythm just as soon as I put it down. Others were saying what, hey, where are those numbers coming from? So, we work on it together and alone. We lost some of them and came back and did some more--then one said, "Oh, I get it!" Then a couple others. I don't know really how that happens.*

In the RIVER ACRES case study Terry Denny discussed "Great Mystery" of "forgetting," (p 1:36). It included the vast differences between classes in different years, "analogous to the good and bad years for wine with school reasons not being so obvious." A teacher there said: (p 1:113)

> *I had no preparation to deal with level 4's--even 3's. (The two lowest tracks in junior high school.) I just never knew how hard it would be. Times and kids are changing. . . . Part of it is the frustration, the extreme disappointment; you need preparation for this. You've taught them, they've known it, they've been tested on it; they've succeeded, and two weeks later they don't know it anymore. That kind of preparation would be awfully hard.*

And a math teacher added (p 1:37):

> *Except for the "block 1's" (35 of 140 third graders) all third graders know one thing perfect in math one day and the next it is gone. . . I mean GONE. (She has all the block 2's--average kids). It is a week, year to year experience. I have had children for three years in a row. Knows his facts up to 19 in addition beautifully in May, comes back in September and he's forgotten them. I mean zero retention. Now what I want you to know is that ALL the kids except block 1, and some of them too, have this mysterious "forgetting disease." Last week I had the "2's" borrowing and carrying and I was so happy and we were all dancing. After Thanksgiving they came back and acted like they had never heard the word "borrow." Borrow!? Teachers live with this. They see it every day and get used to it, so we don't talk about it. But it's there teaching math; day to day.*

The interaction between a PINE CITY mathematics teacher and his students (p 6:37) concerning a new kind of procedure introduced when some members of the class were absent illustrated the elusiveness of the learning experience:

> *"But some of them are away," a student remembers. "This is so easy they'll soon catch up," jokes Mr. Williams. "So tomorrow we can sit back and take it easy," someone replies.*

But at the end of the class Mr. Williams returns to the point:

> *"Don't tell the others what we've been doing because they might think it's difficult. R[illegible] how important first impressions are. . ."*

We hide the mystery partly by talking about skills, entities that seem to have body to them that flourish or weaken, entities that when talked about enough seem to be real. Teachers did not seem to have a good idea of what skills were, only that they result in performance, only that they are important.

Many teachers have had enough of mystery, of uncertainty, of vague promises and unreal expectations. The charm had left the mystery, the parents were angry, and something solid and beyond challenge was attractive. The teachers were not happy about the students' inability to perform (WESTERN CITY, p 7:33):

> *In my classes I have to lecture. Most of my students don't know how to read or they are reading well below grade level. Consequently, I have to resort to lecturing and using worksheets.*

Why can't they read? The teachers did not know. Why won't they study? The teachers did not know. Why can't they remember what they knew last week? We just do not know.

Many of the problems were attributed to low native intelligence. Many of the problems were attributed to low motivation. But those are the problems that schools should have been most ready to deal with. Highly intelligent, well motivated children were learning with only minimum help from the schools. The more influential families wanted teachers who would pay attention to their children. "Let special education remedial teachers take care of the others." But the courts say put them all together. And the special education teachers are specialists in cognitive skills, not about education. So the mysteries of teaching and forgetting are perpetuated.

What educators were doing in the face of these mysteries was to submit learning situations more and more to their control, that is relying more and more on technology. Gordon Hoke told about a mathematics laboratory in VORTEX (p 10:12):

A group of fourth graders began to enter the room. I watched them work with the wide array of both "hard" and "soft" learning aids, recalling a K-1 classroom of several years ago at the University of Hawaii's Laboratory school where I first saw children functioning extremely well with technology. Students there paired off and assisted one another, as a few did in the VORTEX setting. But the effects of Joseph's operational philosophy were apparent: students were working mainly on an individualistic basis. A few were counting on their fingers, and I asked Joseph: "If you had the space, would you want an abacus here?" "Definitely," he replied, "There's a difference in 'hands-on' approaches, and you can see the need for more manipulative experiences."

A girl displayed very low levels of frustration tolerance, and I commented to Tory, the aide. "Yes, she doesn't have much patience," Tory acknowledged, "and the older they get the more you see that kind of behavior. That's why I dread going to School X to pick up their sixth graders." I made that trip with Tory, and the reasons for her uneasiness were clearly evident. The same activity raised other questions that must be faced in the development of special programs.

We drove about six blocks to X where Tory parked her car. The pupils were on the verge of having a "milk break" and some were angered by the interruption. Their teacher promised they could have the milk when they returned. The bus then transported us back to the Lab where students were to spend approximately 35 minutes. "Some days the buses aren't on schedule and we lose a few minutes," Tory said.

Once in the Lab, students rather quickly--surprisingly fast, in my estimation--began working. A few words or gentle shoulder taps from Joseph calmed 2-3 boys and Tory explained to a girl: "If you don't watch what you're doing, the recording won't stay in time with the problems." It was a productive session, almost all pupils finished tasks assigned by their individual folders and were checked-off by Tory or Joseph. We reassembled for the return bus, a different one arriving from yet another corner of the district.

Getting students ready to learn is a crucial matter, particularly those who have a history of learning "failures." Joseph and Tory performed nobly given the constraints of time, space, and scheduling. Their efforts underscored the importance of people who link children to the technology. The role of instructional personnel who function at that point where learners interface with machine appears certain to grow in significance. My own children have had negative experiences in similar circumstances, and it was a pleasure to watch the scene described above. But the "paperwork" often associated with such efforts remains a formidable consideration, and Joseph and I discussed the need for computer-managed systems. The task of blending lab

> activities with classroom routines also must be faced. Joseph's caution that the Lab experience is strictly "in addition to" does not eliminate the classroom teacher's resistance to interruptions nor does it negate the pupils' need for some type of synthesis.
>
> At the moment, media-oriented programs, such as the Math Lab, stand out as isolated enclaves, analogous to the Language Labs spawned by NDEA legislation of the 1950s, a promising and undeveloped aspect of public schooling not yet integrated into a new conceptual and operational mode of education.

The technology of instruction promised to reduce the mystery of learning and the mystery of forgetting, partly by greater individualization, partly by more efficient encounters with the problems, partly by eliminating those learning tasks which did not accommodate to the technology. Central to the technology of instruction was the technology of testing--to be discussed next.

TESTING TO MEASURE STUDENT ACHIEVEMENT

Testing seems a most natural part of the curriculum of schools. No other institution uses tests to the extent educational institutions use them. The mention of testing brings to most people's minds only one institution: schools. A science class in PINE CITY had elements which many citizens of this country would recognize as part of their own school experience (p 6:34):

> Mr. Rodgers starts the physiology class with a spelling test. He reads out eleven words (examples: "autonomic nervous system," "proprioceptors," "neurolemma," "myelin sheath," "excitability," "summation"). Ten minutes later he collects in the papers without comment and begins to check some work the students have already completed. Each student is given a turn to answer the questions. It's a bit like a quiz. Mr. Rodgers reads out the questions and if they get five in sequence correct they score a point. If they get it wrong or can't answer it passes on until someone gets it right, and collects a bonus point. Sometimes the questions go round the class (with mounting excitement) until someone scores. Almost all the questions (which come from the textbook) concern terminology or definitions.

In order to know how well the students were doing the teacher would "test" them.

In the literature of educational psychology, testing is a rather technical and decontextualized subject. For fifty years measurement specialists have held their discussions on test validity, test reliability, item analysis, and differences among types of tests. Many teachers have taken courses in testing from these specialists, but the technical aspects of testing remained outside their technical expertise. At the CSSE sites teachers seldom talked about the technical aspects of testing.

When teachers talked about tests it was in terms of *their* concerns: Are students attending to my lessons? Are these students learning as well as we expect them to learn? Does my teaching match the expectations for teachers in this school and community? Will community and parents view my questions and grading systems as fair and impartial? Concerns like these arise out of the teacher's particular classroom context. Louis Smith, site observer in ALTE, described some of the elements of this context (a portion of which is quoted here; p 3:90):

> On occasion in observational studies the presence and recurrence of little items jell into patterns and conceptions of larger significance. Consider for instance the presence and recurrence of these items across schools, levels, disciplines, and departments:
>
> 1. in most classrooms, a section of the blackboard with assignments for each day of the week;
>
> 2. teachers' grade books literally full, cell by cell, home to be graded (in the evening) or into class to be returned (in the early morning before school);
>
> 4. lab books full of red ink comments;
>
> 5. frequent classroom byplay around the question, "Does it count?";
>
> 6. reviews before tests, taking of quizzes and tests, returning and checking of tests;
>
> 7. in the staff room of one school, the presence of a small test scoring machine for rapid marking of objective tests;
>
> 8. long faculty discussions and memos defining "cuts" and "absences," clarifying responsibility among teachers, administrators and clerks; and
>
> 9. sitting in offices and staff rooms as teachers talk in detail with parents, re: a child's work, both its quantity and quality.

Lou Smith drew our attention to several lines of meaning in these items:

> 1. the teachers play a dominant and influential role in pupil learning;
>
> 2. students are expected to learn, assignments are made, products (homework, lab books, tests) are monitored carefully; and

3. points accumulate into semester grades and grades into class ranks.

Such a context is a performance-oriented, record-keeping context--naturally suited, it would seem, to the technology of testing. But what has been the dominant form of testing over the last fifty years is recitation, an informal kind of testing rather than examination, a more formal kind. Smith continued:

> Finally and perhaps more importantly, the items can be placed up against two more general positions in the literature. First, in a classical review of classroom questioning, Hoetker and Ahlbrand* conclude regarding "the persistence of the recitation":
>
> > *The studies that have been reviewed show a remarkable stability of classroom verbal behavior patterns over the last half century, despite the fact that each successive generation of educational thinkers, no matter how else they differed, has condemned the rapid-fire, questions-answer pattern of instruction. This opens a number of interesting avenues of inquiry. What is there about the recitation, for instance, that makes it so singularly successful in the evolutionary struggle with other, more highly recommended, methods? That is, what survival needs of teachers are met uniquely by the recitation?*

Reflecting on activities of their classrooms, CSSE teachers were primarily concerned about two things: how to get students to perform well and how to live up to the expectations other people had of them as teachers. Satisfying the one did not always satisfy the other, and all people did not have the same expectations. Both recitation and examinations had been designed to measure student performance, to help establish and maintain certain skills. Recitation stood for personal involvement and judgment; examinations stood for quality control and impartiality; all part of the expectation of a competent teacher. The different forms of testing can be viewed as symbolic of and instrumental in the establishment and maintenance of a proper classroom. As the following discussion will indicate, this is particularly evident in the case of teacher-made tests, the most prevalent type of formal testing used in the CSSE sites.

Teachers Learning about Learning. One way teachers learned about how much and how well their students were learning was through homework. This scene in WESTERN CITY was not atypical of a mathematics class (p 7:30):

> . . . there were 24 students present. The teacher made some general announcements and then proceeded to discuss the homework from the day before. Proceeding slowly with the

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*James Hoetker and William P. Ahlbrand, "The Persistence of the Recitation." American Educational Research Journal 6 (March 1969): 163.

> explanations the teacher repeatedly asked if there were any questions. After correcting the assignment, the papers were collected. The teacher proceeded to explain the problems and their solution. The teacher assigned six problems as homework for the following day. Since there was a little time left in the period, the students were told they could start on their next day's homework assignment.

Teachers were idiosyncratic in their methods of finding out how much their students had learned. Some relied heavily on formal closed-book quizzes and examinations. More relied on informal recitation, some expecting or even requiring the answer to come as a read-aloud quotation from the textbook. Others held games. Others used worksheets, some elaborately packaged by commercial distributors. And still others were casual and conversational. All brought the teacher the opportunity to review the skill or understanding or experience of the learner.

Of course it was uncommon to speak of all these feedback solicitations as testing. A teacher usually reserved the term test for something that would be done independently, from memory, and with the expectation of being graded. Lou Smith observed that in ALTE, of the tests he found, "all seemed tied to the broad goals of excellence," (p 3:93). Finding out about student learning was seen as essential to the maintenance of standards. Teachers were quick to mention the shortcoming of tests, and often seemed to take little notice of their results, but were intent upon raising the standards of learning in their schools, and used tests to help them do it.

Most of the tests used in the classroom--as opposed to workbooks and exercise sheets--were developed by the teacher, often using questions from another test or from the textbook or teacher guide that accompanied the textbook. These teacher-made tests were much more closely attuned to what actually occurred in class and as part of the laboratory work or homework than district's objectives-based tests, the publishers tests, the criterion-referenced tests or standardized tests--and to be sure, there were very few of these more formal instruments to be seen in any of the schools.

Teachers were committed to their own testing practices, though often unaware of how arbitrary (even when very good technically) their tests were. They often were puzzled by the results. A teacher in BRT said (p 4:9):

> *From my own tests I would guess at least half the class has really understood what I've taught. Maybe another quarter are borderline. I'm talking about biology now. It's very discouraging sometimes. When I give a test I have lots of A's and B's, a few C's and lots of D's and F's. I don't know whether it's me, the subject, or what. Other teachers don't seem to get this distribution. In chemistry and physics the results are different because the group is more select. They're mostly A's and B's.*

The results they got from tests usually paralleled the results they got from recitation and other interactional forms of quizzing. Student learning was teased out in various ways, even as indirectly as quietly listening to students plan a project or help each other with an assignment. It was not unusual to find that the same students who raised their hands first helped other students most often, had the most detailed answers in recitation, also made the highest marks on the examinations.

From this fact (across the years and across the country) arose one of the great contentions between teachers and testing people. Noting the high correlation (across persons) between performances on different kinds of testing, psychometricians maintained that the format of testing should be based on technical rather than educational characteristics. They demonstrated that they could get the most dependable indicator of who had achieved the most (and, more important to them, who were most likely to achieve the most in future opportunities) from tests that had numerous independent items and were objectively scorable. The multiple choice examination became their standard instrument. Many teachers, students, and others (and many testing people as well) heard them to be saying that most intellectual attainment is of a single kind, a kind that is best represented by the response to a multiple choice item. Many of our CSSE respondents were quick to argue against that conclusion. A young teacher in GREATER BOSTON, noting that the gains in tests scores in this school were not dramatic, believed those scores to be a poor indicator of the success of students and teachers. He said (p 11:35):

> *I don't want to make any grand claims for the system. I just know at this time, with these students, in this school, it (the instructional system) works.*

He amplified the point by asking how success can be judged or measured and what kinds of comparisons make sense.

> *Compared to what went on before the system, compared to what we could do without it, compared perhaps to what goes on in other classes, I have no doubt that it is worth the money it costs. How do you measure it? Against how well children read? Against their attitude to reading as a whole? Or against the chances of them cleaving someone's head in?*

A student in PINE CITY remarked on the inadequacy of tests, even teacher-made tests, in representing what students have learned (p 6:38):

> *Students often learn a lot more than teachers realize. I don't see how you can honestly test a student on his knowledge when it's really the teacher's knowledge you are testing. The teacher gives what he knows and then gives a test to see if the student knows it. To be a teacher he has to know more than the student to start with, or the student would be teaching the teacher. I see giving tests as a way of learning but not as a way of grading a person. . . . They gave you credit for the*

> *way you did things rather than for the answers. Coach Williams would go through a problem step-by-step and give you credit for the [steps] you got right. If it wasn't for that, no one would have passed Math!*

The idea that testing really tells what the teacher knows and has taught has occurred to many management-organization type administrators and assessment specialists, but was quickly dismissed by essentially all of the teachers who talked to us about testing. The technical limits of testing and the non-school determinants of student responses were seen to be too strong. (See BRT p 4:9 for the way one teacher put it.) The teacher component in test scores was seen to be small. There is essentially no reference in the case studies to the use of tests to evaluate teachers or curricula. Lou Smith's survey of instruments in ALTE (p 3:93) yielded a variety of tests that could have been used for that purpose:

> In the course of the semester we collected a number of "tests" used in different parts of the curriculum. More systematic accounting of what the pupils are expected to know would have tied down the intellectual substance of science education. We have excerpted into Figure 27 a few items which capture the flavor of some of those expectations. Some are "fun," some involve intellectual skills, some tap developing concepts and some pull quite specific information. All seem tied to the broad goal of academic excellence.

The most common comment about tests from teachers was that they did not tell anything the teacher did not already know. A teacher in RIVER ACRES wondered whether they were worth the psychic costs (p 1:65):

> *Kids see more than we measure either by our standardized tests or by our letter grades. The sixth grader wants to do more and feels inadequate of what he has not learned. He is mortified. He doesn't need to be embarrassed publicly.*

As we talked to curriculum coordinators and teachers it became clear that only the few who could work extensively with individual children had an idea of the knowledgability youngsters had of particular science topics. Tests available commercially or through government agencies or university projects were not seen to be capable of providing other than a very narrow review (via criterion referenced testing) or extremely general indication (via commercial achievement tests). A teacher who spent an extra two weeks on weather or on world markets and had reason to believe that her class became very well informed could not expect to have this knowledgability show on any available tests.

This was not a situation peculiar to the sciences. Tests of subject matter content, to the extent they ever existed, have been replaced by tests of skills in all the subject matter areas. It has not been so much a problem in mathematics because the emphasis there has traditionally been on computational operations and other skills and less on conceptualization of content. But it has been a problem for those who would like to know what individual students understand about physical and social science topics.

This is not to suggest that many teachers were interested in taking inventory of knowledgability (e.g., for using previous acquaintance with topics as a basis for new assignments). It is to suggest that understanding of specific science topics is not being inventoried by any available testing, including the National Assessment of Educational Progress. Given the immense scope of new knowledge available to the ordinary citizen, the scope of understanding science topics is not known, nor even whether or not the contemporary youngster is more or less "scientifically literate" than the youngster of a generation ago. These inventories and comparisons may not be important knowledge, but because many tests are used, it is sometimes incorrectly presumed that we can make decisions on such knowledge.

Teachers Telling About Learning. Teachers have the obligation to keep records of the academic progress of youngsters--and to keep them and their parents informed of their achievement. There are many informal ways teachers have of acknowledging responses good and poor. The formal way is largely the grading system.

Attempts to standardize grades were underway in several schools. In RIVER ACRES a "fine-grained" district-wide grading policy had been recently adopted. As Terry Denny reported (p 1:11):

> 100-93=A
> 92-85=B
> 84-77=C
> 76-70=D
> 69-00=F
>
> It has its detractors and there is a small minority of elementary teachers who would abolish grades completely. "We have to. Its our policy. I'm against them. Social promotion means a child should be provided for. A good society would promote good education for all children." For the most part, though, teachers and parents find the grading policy and practice to their liking. Notable exceptions (occur) when grading creates problems in the context of achievement or ability grouping.

As noted the policy seemed to hide a number of differences of opinion. Each teacher was obligated to use the common grading system at that school, but most were free to add additional informaton to the grade reports. Different teachers continued to interpret the grades in different ways.* One teacher in FALL RIVER said (p 2:17):

> *"I carry on a reality therapy in my classroom, like Glasser's Schools Without Failure. I try to base my class on that. That's where you make a kid responsible for his actions. . . Responsible behavior builds a success identity. . . . I establish for my success identity that no person will get less than a C in my class if they have demonstrated responsible behavior in the laboratories and have tried, on all the tests to do their best. . . . In a majority of cases, this is successful. . . . I've removed the pressure of the tests so they do better on the tests. You can't get an accurate picture of what the kids know with all the pressure and anxiety that's built up from the tests."*

Measurement specialists continue to talk about the technical inadequacies of grades, but the teachers of our CSSE schools did not. When they referred to grades they considered them as fixed, part of the system, causing some problems but largely necessary, compatible with the student's and parent's concern about scholastic achievement, and consistent with the administrator's (and increasingly the legal office's) demand for proper ledgers.

Often the talk turned to the problem of keeping grades "in perspective" (p 4:15):

> Their grade--that's all they think about. Getting through that test and this test. I would hope this isn't true, but that's the feeling I get from them.

Terry Denny, the observer in RIVER ACRES, (p 1:89) also noted the emphasis students gave to grades.

> Regardless of the level, the shared goal of the students in science is "to get a good grade." Students in levels 2, 3 or 4 (which have 95% of the students) do not say they are in physical science or biology to learn something substantive about the field. The reasons for getting good grades were several -- but grades are the thing. Level one students did talk about science, about their interest in it -- and about getting good grades. The competition for getting good grades appears to be considerable in the upper levels.

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*See Louise W. Cureton, "The History of Grading Practices," Measurement in Education 2 (1971).

As in John Ogbu's study of schools and community,* some parents were suspicious of teachers grading practices. Visits to schools and calls to teachers were made by some parents to obtain reassurance of the teacher's sensibility and impartiality. The teacher usually would turn to tests, exercises, and work samples to explain the grade, but the exact rationale of the teacher's interpretation remained unclear.

Although not one of the pressing education problems (except in an occasional instance) and although not an obstacle to providing good instruction in science, math and social studies, grading procedures in schools were complex and problematic. Various people needed to know about the progress of students. Various decisions had to be made, and basing those decisions on academic grades however questionable, had some merit and custom on its side. The current efforts being made to improve the quality of the information contained in tests scores and grades were not encouraging. The greater the effort the greater the tendency to isolate the simpler and less meaningful aspects of an education as the things to be tested for and graded. From what we heard in schools around the country, a happy solution was not in sight.

Other Uses of Testing. One of the original intentions of the CSSE staff was to study the relationship between the use of standardized achievement tests and other observations of student learning. This aim was sidetracked because none of the observers indicated much of an interest in probing the question and at none of the schools did we find standardized testing to be much of an issue.

At the time of these visits the popular press had given great attention to the fact that CEEB college aptitude test scores and other test scores had (for the nation and for most local districts) continued a decade of slow decline. A distinguished panel**found the decline attributable to a number of conditions, none of them singly influential, several of them suggesting a deterioration of the academic attitude within the schools. The teachers and citizens we talked to seemed little interested in the score decline per se, were quite interested in various signs that the academic attitude was deteriorating, not persuaded that the quality of the school offerings was diminishing, and much more concerned about local and individual problems of motivation, performance, and obstacles to the conduct of "ordinary" instruction. The national picture was just not accepted as indicative of problems locally.

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*John U. Ogbu, The Next Generation: An Ethnography of Education in an Urban Neighborhood (New York: Academic Press, 1974), pp 95-96.

**College Entrance Examination Board, On Further Examination, Report of the Advisory Panel on the Scholastic Aptitude Test Score Decline (New York: 1977).

In WESTERN CITY site observer Rudy Serrano (p 3:47) reported that placement in math "levels" was based almost entirely on standardized achievement test scores. Similarly, in ALTE (p 3:47) placement in math tracks was influenced by standardized achievement test scores although parent opinion was given precedence when it conflicted with test scores.

In an example of the symbolic value of standardized test scores, the junior high principal in BRT (p 4:3) used tests to justify his claim that in spite of small size, his school provided as good an education as any other school. We thought that school people might be discouraged because tests and other data were not sufficient to maintain public support of their programs. In our survey we asked about the claim:

> Our school district does not seem to be able to obtain objective evidence of student achievement that would persuade a skeptical visitor that the science teaching here is effective.

and found these proportions agreeing with the claim:

Administrators	30%
Curric Coord's	41%
Teachers	26%
Seniors	26%
Parents	35%

Large numbers sought better evidence but for the most part the respondents seemed to be saying that they did not need better evidence than they had to indicate the effectiveness of their science instruction.

Teachers, administrators and others at several of the sites were dismayed at the amount of time scheduled by the district to be spent testing for one purpose or another (in addition to the testing of various kinds already being done by the teachers and counselors for their purposes). In ALTE and ARCHIPOLIS site observers noticed that testing took place frequently in many classes. Nevertheless, teachers did not appear to have much taste for the information tests could provide about individual student problems or problems with their own teaching. This was consistent with reports of Hotvedt and Hastings et al.,[*] who found teachers did not value the information provided by tests as highly as the judgment they could make based on their own observations in the classroom. Scheyer[**] concluded that teachers make little use of test results in making instructional decisions. "Teachers see children in greater complexity than tests can measure," Scheyer noted. It appeared that, like grades, standardized tests provided little specific information to help the teacher make instructional decisions.

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[*] Martyn Hotvedt, "Teacher Uses of Testing" (Paper delivered at the J. Thomas Hastings Symposium on Measurement and Evaluation, Urbana, Illinois, January 30, 1978) citing particularly the work of J. Thomas Hastings, Philip J. Runkel, etal, "The Use of Test Results" (Urbana: University of Illinois Bureau of Educational Research, 1960).

[**] Patricia Scheyer. "Test Results Revisited," The Cornbelt Education Review: A Graduate Student Journal, mimeographed (Urbana: College of Education, University of Illinois, 1977).

New emphasis on testing seemed to be emerging in some sites. There was widespread belief among district offices that instruction could be made more effective if a highly-structured, hierarchal program of study were devised, as reported in Chapter 14. When math supervisors and teachers were asked about the claim:

> Students have been promoted without knowing basic mathematics

sixty percent of the supervisors and ninety percent of the teachers agreed. They sought ways of keeping students out of instructional situations for which they were not prepared. More testing seemed to be needed. We found some teachers optimistic about the diagnostic uses of testing and some frightened by the possibilities.

In some sites scores seemed to be used whenever decisions about pupils had to be made. Perhaps this reflected new attitudes about the importance of documenting learning with test scores, or perhaps it reflected the development of criterion-referenced testing. As indicated in Chapter 14, if this is a general trend in education, it deserves further study. A criticism of testing noted once or twice in the case studies was the possible impact of standardized testing on the curriculum. Substantial attention to testing appeared to foster a distinction between instructional time spent on the more narrow range of achievements measured by the test and instructional time spent on achievements not so well measured by the test. One very obvious example was the effect of standardized tests in reducing the amount of practice students have in composition; this was mentioned by a teacher to a site visitor.

> *We've gotten into a testing routine, which may be very fair in terms of ranking, but it superseded the old, written essay type of system and one of the consequences of that, it seems to me, was that we used to accidentally teach people a lot, or help people learn a lot, because they had to write out what they thought. I sometimes wonder if we haven't harmed their learning in the attempt to be fair in rank-ordering the students.*
>
> *Maybe the whole idea of objective tests has taken away from the student the chance to learn a lot that you do learn when you have to sit down and write it out.*

With such criticisms, why then would the use of tests, both teacher-made tests and standardized tests, increase?

An answer may be found by examining the functions of tests from professional and institutional perspectives. Although formal testing did not seem to satisfy much of the teacher's need for knowing what the student knew, testing did seem to assist in socializing students and maintaining control over them. In VORTEX the pedagogy was more formal than in the other sites; there, except in the one middle school and the individualized remedial reading program, both of which, incidentally, were controversial, testing was limited to a few teacher-made tests each grading period. In places where instruction was less formal, perhaps because of declining student interest, testing was an important means of socialization and control. Testing was relied on to motivate the students. The information provided by tests seemed mainly used in the justification of past decisions and the allocation of further opportunity.

STUDENT MOTIVATION

Student motivation was seen as a major problem in most of the sites we studied. One BRT teacher identified it as the major problem:

> *My biggest complaint about teaching is the frustration thing. It comes from motivation. I don't know if it's me or them. I don't understand why kids are not more motivated. Part of the answer must be in me, but it's hard to look at yourself and see other than what you want to see. (BRT 4:24)*

The frequency with which we heard such remarks across the country indicated that student attitude was a prime concern. Mary Lee Smith found it to be the most common professional topic in the teachers' lounge at FALL RIVER (p 2:8). One site visitor at ALTE heard:

> *They're dead now. Withdrawn.*
>
> *In the last two or three years, there's a lot less enthusiasm.*
>
> *You try to get them involved in the problem, and I can't get them involved anymore. They just sit there. I ask them a question--a very simple question--and I can't get anybody to answer.*

In PINE CITY (p 6:15):

> *Most teachers agree that the key problem is motivation. In every class there are one or two, perhaps sometimes it's more, who just sit there, and whatever you do, however hard you try, it's just really difficult to reach them.*

Administrators were also concerned about the behavior and attitudes of their students; a PINE CITY junior high school principal identified it as one of his major concerns, the other being the efficient running of the school (p 6:11).

And when we found a younster whose motivation was exemplary other doubts came to our minds. In Rob Walker's case study of GREATER BOSTON he described Helena (p 11:38):

> Helena seems unusual amongst the students in believing so strongly that school and education have something to offer to her. It's not just the job prospects she values, but the process of Education itself. "I like to know things," she says, "when someone uses a word that no one else understands, but I know what it means, then I feel good. I like to be knowledgeable, to be someone that people know they can ask when they want to know something, whether it is the speed of light, or whatever it is."
>
> . . .
>
> Helena is articulate and headstrong, and some of the other students seem to find her a little overwhelming. She needs the attention and praise of adults to support her moral stand against her peers. The question she raised for me was whether the students who committed themselves to the explicit values of the school were those whose motivation stemmed to some degree from their alienation from their peers. Are those students who best succeed in academic terms often those who feel themselves misfits amongst other students?

The problem of academic motivation is not a simple problem. Some of the youngsters and teachers least concerned about achievement may have been making more sense than the rest.

But the norm was: low student motivation is a serious problem. The lack of academic motivation showed up in numercus ways. One was the refusal to even be in school: Rob Walker reported that in GREATER BOSTON, on any given day, about 70% attendance in the high school was to be expected. A more subtle expression of motivation (or rejection of school) was a passive non-involvement, shown in the incident in which a FALL RIVER teacher chided a student for not paying attention to the question and he responded, "I heard the question; I just don't care." (p 2:12)

Students were said to have their own idea of the purpose of school. One high schooler in FALL RIVER talked about Happy Days and American Graffiti, saying many of his/her classmates felt that school should "be fun, the happiest time of your life." (p 2:74) During our site visit, a junior high school teacher in Texas described a similar "social" role for the school, as far as her students were concerned:

> *Yesterday my students came into (class) to visit! And anything I had to say was strictly secondary to what they were there for. . . I finally got tired of calling them to attention four times and trying to address the backs of their heads. And I let them know if they could not listen, perhaps they could read the instructions from the blackboard. . . It upset me a very great deal to have to resort to that.*

A BRT high school social studies teacher (p 4:43) said:

> *It's almost as though we have to prove why we're here, why we're functioning. (They as much as say:) "What makes you think you have anything of value to teach us?" You know, I get the feeling many times that I'm on the defensive as a teacher. It isn't enough that I stand up and say, "This is your assignment." I almost feel as though I have to prove it, to prove that there's value in doing it, other than the fact that I just want them to do it.*

Across the country, we gained a clear sense that many students will not accept the word from school authorities that "it's good for them."

We observed a number of ways the schools attempted to change student motivation. First, the students were allowed a greater range of electives thereby giving them the opportunity to "find their own level." In some cases, the fact that a course was an elective raised academic performance as students who were more genuinely interested in the subject enrolled. An administrator in URBANVILLE told our site visitors:

> *We fully expected that the number of kids who took math at the senior high level would drop off (because of letting 9th graders take courses required for graduation) but this didn't happen.*

He said the grapevine kept enrollments up.

> *You can enjoy this class.*

On the other hand, during our URBANVILLE site visit we heard that the courses considered difficult attracted those who were status-conscious:

> I suppose many students sign up for calculus even when they're not motivated because they like to be in honors courses. There's a certain amount of ego attached, and they have a certain status being in the course. And some of them can get by comfortably without really putting out.

This sort of thinking, on the part of both parents and students, was described in both the RIVER ACRES and FALL RIVER case studies. If a class was perceived as "an easy grade," students not interested in working sometimes enrolled in disproportionate numbers. It created a major problem for the teacher and further discouraged more motivated students from selecting it. (See BRT, p 4:42, the description of the social studies program.)

Teachers reported trying to motivate the less able (or less willing) by making their courses "more relevant," i.e., relating them to every-day happenings. However, it appeared that understanding the adolescent well enough to know what is relevant is no easy task. One biology teacher told about including a discussion of Legionnaire's Disease in a lesson on infectious diseases, but found the students showing the "characteristic inertia." Such reactions arise partly from a lack of imagination on both sides. The adult is often unable to comprehend what will be of interest to the age group he/she is addressing. He/she is unable to get into their framework to the point of relating the subject matter to their concerns. On the other side, the student pleading for "relevance" is handicapped by a highly restricted view of what sort of background knowledge may eventually be useful. The attitude expressed by the PINE CITY student (p 6:38) was typical:

> *I knew by ninth grade I wanted to go into criminal justice so I found myself asking why Biology? It's a question a lot of students ask themselves. Why Science? And it's not a question the school really answers.*

This student clearly thought he was able to predict his own future well enough to decide what he could afford not to know.

A similar attempt to motivate the student has been by homogeneous grouping. One viewpoint we heard frequently was that grouping enabled the teacher to put together those students who wanted "to work" and to give them theoretically-oriented courses, while students who had less intention "to work" could be put in a more practical, applied version of the subject. (This policy is related to the view of science as an elitist pursuit. There is a good discussion of the pros & cons of grouping in the GREATER BOSTON case study, discussed in Chapter 12, (p 11:12 ff.)) Teachers who advocated this position justified it by claiming that students demand a "watered-down program" when they don't see the subject matter as having a direct pay-off. (See BRT, p 4:4)

But once students are in the lower track they may feel they have been branded as losers, adversely affecting their subsequent motivation. LaMar Miller has commented on this phenomenon:

> *All of the recent investigations seem to point to the fact that grouping often stresses a sense of failure in a consistent decline in morale and effort.**

This is what led some teachers in favor of mixed classes to say:

> *When I look at the problems schools face I think the only answer is for us to put our trust in democracy. (GREATER BOSTON, p 11:13)*

There was evidence that teachers and schools were seeking new ways of motivating students who performed at what they considered unsatisfactory academic levels. Individualized lab instruction was one such method. In GREATER BOSTON, the Reading Lab teacher said (p 11:35) that:

> *A lot of (the) success. . . (with the lab) has been with students who had got to the point where they wouldn't read along in class. . .*

In this setting, he stressed the value of what they learn for their own welfare. In addition, they were awarded certificates after 30 and 60 units of work. Observer Rob Walker suggested that the closed learning environment and the depersonalization of the lab seemed to be important for students who were operating there (GREATER BOSTON, p 11:35).

Peer review of classwork, rather than peer competition for teacher approval or grades, was another method being tried. The discussion of the GREATER BOSTON writing workshop (p 11:37) is illuminative. There peer review was highly informal, consisting of simply duplicating and distributing the students' writing on each given topic.**

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*Lamar Miller. "Testing Black Students: Implications for Assessing Inner City Schools," The Journal of Negro Education 44 (1975): 412.

**A more rigorous form of review, consisting of class discussion of individual work, has been claimed to be highly effective, see for example: Jean Seligmann and Sylvester Monroe. "A Teacher Who Gets Results," Newsweek, 12 September 1977, p. 67.

One BRT teacher we spoke to had attempted to develop a "communal spirit" in her class by instilling in each of her students the idea that everyone in the class had to participate actively for the class to be successful. A cooperative spirit in a classroom can be effective (as noted also in the GREATER BOSTON writing workshop), but our BRT teacher reported she was not able to "talk her class" into this mode of behavior.

Part of the problem is that the old-fashioned "carrots and sticks" are seen as no longer effective for many students. Unless the teacher changes and adapts a technique such as competition, she/he often feels that she/he has very little means of pushing students along. The grading system, the main in-school teacher-adult reward system, was being subjected to enormous pressures in the eleven school districts we visited. A part of its motivating value appeared to be eroded. (We discussed grades as indicators of learning in the previous section.)

However, an interesting effect that we noted during the course of this study was that both individual competition in classroom performance and the grading system continued to motivate the more academically able student. Lou Smith commented on the competition "for data, for pictures, for getting finished on schedule" (ALTE p 3:54) that was occasioned by the junior high school publication, "Images of our Community - Alte." He made frequent reference to the district's level of academic achievement and noted that grades had a real impact on the student since they in part determined whether the student would be recommended for courses which were prerequisites for the "heavier" academic courses and subjects. The fact that students were concerned about which grades count and which did not suggests that their behavior was influenced by the grading system. In the RIVER ACRES study, there are a number of references to student competition in the top levels; the teachers of the seventh grade science team describes it as "rip-roaring" (p 1:63). A Biology II teacher of level 1 students said (p 1:88):

> *They really put out because they want the grades.*

Observer Terry Denny commented (p 1:89):

> The competition for getting good grades appears to be considerable in the upper levels.

This apparent split between the two populations of students raises an intriguing question. Is it the case that these motivational methods have lost their "push" with the less willing/able academically, or is it the case that they never had much force with these groups and their ineffectuality is just surfacing? It may show now along with the widespread questioning of the core values of the academic establishment.

We found that the concern about a course grade did go up when the course might be failed, and the failing grade might prevent early graduation. As indicated in Chapter B, the older students need money, particularly for operating cars. They need to have a job. From RIVER ACRES we heard (p 1:118):

> *Kids are getting more and more jobs. Getting good grades is not as important as getting money. These kids want out. Especially level 3 and 4. . . They aren't motivated to get good grades, to (then) get a good job, to then get money. They are motivated to get money today.*

Graduation is a goal because it will free those youngsters to get a better job (BRT p 4:42):

> *The sociology class has twelve students, most of the seniors. Mostly, they're slow students. They're looking for a course with a minimum amount of work. They're not interested in facts. They have opinions but won't go to the trouble to back them up with research. The one thing they're looking forward to is graduation.*

We have claimed that grades are motivating for some of the students. Such a statement is sometimes assumed to mean that grades are motivating because they signify that certain facts and concepts have been mastered. That kind of communication apparently was not what motivated the students we talked to. They did not think of themselves as mastering a certain body of knowledge, but more as mastering (and of course not mastering) those things being required by the teacher or the test. The knowledge domain was not a reality--it was a great arbitrary abstraction. The grade was a reality. We had a large body of evidence, from both the case studies and the site visits, that supported the idea that grades had intrinsic value to these youngsters. An ALTE high school science teacher discussing a shift of enrollment from Quantitative Biology to General Biology, was referred to in Lou Smith's notes (p 3:67):

> She attributes (it) to lower parent expectations and the fact that an able kid might get a 3 or 4 in General Biology but only a 2 or 3 in Quantitative Biology. The kids want the higher grade average, regardless of learning, for the college admissions race.

A BRT high school science teacher (p 4:8) said:

> *The students who take the upper level classes are so motivated to do well they can go ahead toward whatever their goal might be. Their grade--that's all they think about. Getting through that test and this test. I*

> *would hope this isn't true, but that's the feeling I get from them.*

This differential effect of grades for the academically more- and less-able was reported by a RIVER ACRES junior high mathematics teacher (p 1:49):

> *For many of the kids the grade is the only thing that challenges them -- particularly the upper levels. I have half my level 3 class that is not turning in their work and the other half turn it in only for the grade. No grade, no work.*

The middle range of students is seen as being indifferent to grades in districts large enough to have a highly stratified student body: In RIVER ACRES (p 1:65):

> . . . Students in the top and bottom groups often share an interest in grades--more so than do the middle or "average" groups.

A junior high teacher in the same district made the following statement (p 1:89):

> *Regardless of the level, the shared goal of the students in science is "to get a good grade." Students in levels 2, 3 or 4 (which have 95% of the students) do not say they are in physical science or biology to learn something substantive about the field. The reasons for getting good grades were several--but grades are the thing. Level 1 students did talk about science, about their interest in it--and getting good grades.*

We heard from many sources that students were reflecting their parents' attitude, which seem now less supportive of the schools than they were in the past. Negative ideas and feelings expressed at home about specific courses or disciplines showed up in school. (See for example the comments about mathematics, BRT pp 4:4 and 4:9. Occasional positive attitudes are also reported, such as the increased enrollments with the in-migration of "pro-chemistry" families in RIVER ACRES, p 1:92.) But in some places there is less push from home for student achievement and some instances we found pressure from parents for easier grading. Here's a statement we heard during an ALTE site visit:

> *Parents are different. They've changed in the last ten years. They want their kids passed to avoid hassels. They're no longer pushing as much.*

We heard this attitude was to be found in teachers, too (RIVER ACRES 1:59):

> *We have lost our work ethic. School is for entertainment. Parents, teachers and children have lost appreciation for education. They want to be rewarded for performing any kind of work. Rewarding effort no matter what the quality of the product is.*

And (p 1:118):

> *I'll draw you a hard-edge picture of our incoming parents: They want straight A's for their daughters and good grades from their sons. They don't care where it comes from, what the kid learns. They want to see the grade.*

During an ALTE site visit, one of the math teachers spoke about the inherent dangers in motivational aids:

> *You have to be careful that the applications, the games, the motivating things you use are not being done for the sake of those things themselves. They have to be a vehicle by which these kids can learn basic skills.*

In the case of the grading system at least, the motivational aid was an end in itself. The case can be made, it seemed to us, that the grading system was motivating for students who want the approval of teachers and parents. It had very little to do with producing or selecting students who would have a deep commitment to science.

Vignette on Motivation. The ubiquity and severity of the motivation problem seemed to call for special efforts from support agencies. Ralph Tyler* had recently commented that:

> *many school problems are attributable to lack of motivation.*

He went on to say that technology can help with some teacher tasks

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*Ralph W. Tyler, response to "Via Technology to a New Era in Education," by William C. Norris, Phi Delta Kappan 58 (February 1977): 455.

> *but has limited value in others, especially motivation, developing confidence. . .*

That probably is too limited a consideration of technology, at least not consistent with the definitions used in Chapter 17.

But even in the most mechanized of instructional systems there may be answers to some of the motivation problems. In a case study of the PLATO computer-assisted instructional system* Bernadine Stake documented the strong and durable contribution that system made toward motivating children to learn fourth-grade arithmetic. Most children considered themselves to be taking control of the learning session and made the technology work for them. They needed the teacher's help to learn how to do this, and they needed curricular materials programmed in such a way that they could rely upon their own initiative, pacing, and interests:

> Sara smiled as she worked on PLATO. She did an ADDITION CHECK-UP (Whole numbers). She had no trouble following directions or working the problems. Sara typed slowly. She read the directions slowly and carefully as she worked. Her second lesson was RUBBER STAMP (Whole numbers). Again she advanced through the lesson with no trouble.
>
> Her third lesson was PARKING LOT (whole Numbers). Sara finished the "fives" easily. PLATO informed her that she was ready for the 'sixes.' Sara turned to the observer and said, "I don't know the sixes and I don't want to do them." The observer knew that most children her age were working on the sixes so she asked Sara if she didn't want to try them. Sara said she did not want to.
>
> Not listening, PLATO presented her next problem: "5x6". Sara worked it even though she had said she wasn't going to. Her answer was correct. She clapped her hands and seemed happy with herself.
>
> The authors of the lessons had structured them in such a way that most children continued to be successful,

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*Bernadine Evans Stake. "PLATO and Fourth Grade Mathematics," Journal of Children's Mathematical Behavior, in press.

but at the same time, challenged rather than bored. At the same time that Sara was saying that she wouldn't do the 6's, PLATO continued to present the lesson and hold her attention. Sara was helped past the threatening situation. PLATO managed to create a positive situation out of a potentially negative one. The authors worked long and hard to invent ways to hold children's attention and challenge their thinking. In most cases they stretched the use of the hardware to accommodate the learning situation.

Sara then chose SPEEDWAY (Whole Numbers) from the game slot. Sara looked over at Kathy's terminal and asked Kathy which race to do on SPEEDWAY. Kathy said, "Do GRAND PRIX." Sara chose GRAND PRIX. Kathy and she discussed the game. Sara entered herself as "RACER" and named her opponent, "SLOW POKE." RACER worked hard to win. She missed 4x1. She got it right on the second try. When PLATO took time-out to say, "Great, you got it right this time," Sara said, "OK, OK," indicating "Let's get on with the race--I don't need to be told I'm right."

Sara gained four years that year according to the achievement tests. At the beginning of the year Sara had had to sit by Ms. Hamilton to do math. By midyear she was on her own.

Ms. Hamilton used PLATO as a "behavior modifier." She said she had to. She pointed to Ted as an example.

At the beginning Ted had been terribly competitive. He gave up if he could not win. On PLATO he was different. Ms. Hamilton said that at the beginning of the school year when Ted was finished with PLATO he was finished with school, so he was required to finish other lessons before he could work on PLATO. Ms. Hamilton said:

> *Ted is doing much better. His work habits have improved a lot. At the beginning of the year, I couldn't get him to write a sentence. Today he chose writing as an activity. His coordination is poor, but he's very fast on PLATO. Ted has gained much more control and his writing has really improved. Ted is happy with himself now and I feel PLATO gets a lot of credit, maybe not all, but PLATO made a big difference.*

Ms. Hamilton was asked if she would prefer having a teacher aide or PLATO. She chose PLATO without hesitation.

> *I think more children profit from PLATO than from a teacher aide. I think they learn things that an aide cannot teach such as concentration, skim reading, which is very difficult to get kids to do. They learn to pace themselves, to be intently involved. The trouble with one-to-one with a teacher is the students become so dependent and I think they become independent with PLATO. I have to balance that to say there are times when a teacher has to help at the terminal.*

INDIVIDUAL DIFFERENCES

The diversity of student performance, experience, motivation and all else was repeatedly apparent to us at the sites. The insights, beliefs and recommendations of the youngsters varied greatly--as everyone would expect. How these differences were affecting student learning was the subject of a previous section in Chapter 14 entitled "Diversity of Wants and Standards," particularly in the first subsection on "Heterogeneity."

The only differences we will take particular note of in this section are differences due to sex and differences due to race or ethnic background.

Sex Differences. That girls do not achieve as well as boys in science is a widely accepted belief that is supported by research evidence. At the secondary school level and above, the achievement test scores of girls are generally lower than those of boys.*

The National Assessment of Educational Progress (NAEP, 1975) reported that males generally perform better than females in mathematics and science. Although there are few differences at nine years of age, the differences are evident at thirteen and continue to increase through adulthood.

Females are underrepresented in science-related careers. The lesser achievement of girls in science has been the subject of several inquiries in recent years; most of the studies have focused on mathematics.

Many of the case studies that have been reported here included some mention of differential course-taking behaviors or preferences, as will be described later. However, sex differences received relatively little attention in all of the studies. This probably resulted from a combination of factors. Other issues were viewed as more important there and more in need of coverage here. Sex differences may be so ingrained that many school personnel and researchers are not aware of them. Perhaps the differences were actually relatively minor at some sites.

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*L. C. Comber and John P. Keeves, Science Education in Nineteen Countries, International Association for the Evaluation of Educational Achievement (New York: John Wiley & Sons, 1973); Elizabeth Fennema and Julia Sherman, "Sex-Related Differences in Mathematics Achievement, Spatial Visualization and Affective Factors," American Educational Research Journal 14 (Winter 1977): 51-71; L. E. Tyler, "Sex Differences," in Encyclopedia of Educational Research, 4th ed., ed. R. L. Ebel (Toronto: Macmillan, 1969) pp. 1217-1221.

Sells[*] referred to mathematics as a "critical filter" for the admission of women (and minorities) to higher education programs and, consequently, to careers. She cited data for the 1972 freshman class at Berkeley which showed that forty-three percent of the males and ninety-two percent of the females did not have the prerequisite courses for the standard freshman calculus sequence. The sequence is required in many undergraduate programs as well as upper division courses in such areas as business administration, and is "essential" for sufficiently high scores on tests required for admission to law school. People who do not have the calculus sequence tend to end up in the "traditionally female, lower-paying fields of criminology, education, journalism, librarianship, social welfare, and the humanities." Rowe[**] said that while remedial programs can often help students with inadequate backgrounds catch up, it appears to be more difficult to overcome mathematics deficiencies.

Fennema[***] and Fennema and Sherman[****] postulated that girls' mathematics achievement test schores are lower primarily because they have had less exposure to mathematics education than boys. They found that smaller proportions of girls than boys enroll in optional mathematics courses, a finding that has been confirmed elsewhere.[*****] When differential course-taking behaviors were controlled, test score differences tended to be reduced to non-significant levels.

With the possible exception of spatial visualization skills, cognitive variables do not seem to be related to sex differences in mathematics achievement. Although further research is needed, it appears that there may be sex-related differences in spatial visualization skills and that those skills may be related to mathematics achievement.

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[*] Lucy W. Sells, Mathematics as a Critical Filter for Minorities and Women: Problems and Solutions (Washington, D. C.: The American Sociological Association, 1976), pp 2-3.

[**] Mary Budd Rowe, "Why Don't Blacks Pick Science?" Science Teacher 44 (February 1977): 34-35.

[***] Elizabeth Fennema, "Influences of Selected Cognitive, Affective and Educational Variables on Sex-related Differences," mimeographed (Madison, Wisc.: University of Wisconsin-Madison, 1976).

[****] Fennema and Sherman, op. cit., 1977.

[*****] Lucy W. Sells, "Preparatory Education for Women and Minorities," in Developing Opportunities for Minorities in Graduate Education, (Proceedings of the Conference on Minority Graduate Education, University of California-Berkeley, May 11-12, 1973); Donna M. Kaminsky, Edsel L. Erickson, Martin Ross, and Leila Bradfield, "Why Females Don't Like Mathematics: The Effect of Parental Expectations" (Paper presented at the American Sociological Association Annual Meeting, New York, August 1976).

Social influences, primarily sex-role socialization, seem to be the basic factors underlying sex differences in science and mathematics achievement and course-taking. Several people who responded to the NAEP announcement attributed the differences to sex-role socialization. In a review of the literature, Fox identified several social influences on mathematics achievement.[*]

> *The perception of the usefulness of mathematics for future educational and career plans and the support or lack of support from significant others appear to be the major factors associated with women's decisions to elect or not elect advanced courses in mathematics. These factors are in turn influenced by the stereotype of mathematics as a male domain. Other factors associated with course-taking and achievement are attitudes towards mathematics, feelings of self-confidence, and values.*

Fox found that girls are less oriented toward careers than boys, particularly careers in mathematics and science, and tend to be unaware of the importance of mathematics and science to careers. Ernst[**] found that boys who do not care for mathematics study it anyway because they perceive its utility. In the RIVER ACRES case study, it was noted that boys tended to drop a level in mathematics more often than girls (p 1:66), perhaps this occurred because some boys found courses they had taken because of social pressures too difficult. Fox cited research which indicated that parents, peers, teachers, and counselors tend to reinforce stereotypical attitudes toward mathematics as a male domain, discouraging girls from taking advanced mathematics courses, failing to encourage them to do so, or accepting their poor performance in the courses.

Anxiety toward mathematics, or "mathophobia"[***] may be related to low achievement in or avoidance of mathematics. An exemplary high school science teacher in BRT admitted that she was among what she perceived as the majority of people who are afraid of mathematics, and indicated that she had communicated this to her students (pp 4:8-9). She also said that students were "scared away" from physics and advanced chemistry courses. Social stereotypes might well intensify such anxieties among females.

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[*] Lynn H. Fox, "The Effects of Sex Role Socialization on Mathematics Participation and Achievement," mimeographed (National Institute of Education, Baltimore, Md.: The Johns Hopkins University, 1976).

[**] John Ernst, Mathematics and Sex (Santa Barbara: University of California, 1976).

[***] Lewis R. Aiken, Jr., "Update on Attitudes and Other Affective Variables in Learning Mathematics," Review of Educational Research 46 (Spring 1976):295.

Lou Smith, in the ALTE case study, found evidence that supported the above analyses. Although the same curricular choices were available to boys and girls, fewer girls take advanced science and math courses (p 3:48):

> A number of teachers take strong value positions here. One teacher commented about self images of female students.
>
> > *The girls say "I'm not good at math" and find excuses not to continue studying it. But the boys say "I think I could get it--I just don't study hard enough." I have been working with the girls, and I might have gotten a few back on the right road this year.*
>
> If these comments are veridical, if one subscribes to the value position that equal numbers of girls should be moving toward professions involving science and math and if the youngsters' parents agree, then the attitudinal roots lie, in part, well before the curricular choices in the high school.

Rowe[*] said that "successful scientists tend to have a stronger sense of fate control than do less-successful scientists." People who have an internal source of fate control believe that they can significantly influence the direction of their own lives; people who are externally controlled think they are ruled by other, sometimes unknown or mysterious, people and forces. Groups, such as women and minorities, who have experienced powerlessness and discrimination tend to believe that they have relatively little control over their own fates.

Evidence from some of the case studies suggested that course-taking patterns may be changing. The number of high school girls enrolling in science courses was increasing in URBANVILLE (p 5:14). Students and teachers attributed this to changing attitudes among counselors, parents and peers. The perception of science as a male domain was decreasing, and people were becoming more aware of its utility for career opportunities. The proportion of girls taking upper-level high school mathematics courses was higher than expected in PINE CITY (p 6:36), and was increasing in RIVER ACRES (p 1:98). However, although junior high females in RIVER ACRES may have been under increasing pressure to take advanced courses, they did not necessarily like them or achieve as well in them as boys (p 1:66).

> The counselor said that for everyone that wants to go up a level (in mathematics), five want to go down. (Boys want to drop a level more frequently than do girls.) This is a peculiar trend in that across all subjects about two in three

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[*] Rowe, Op. Cit., 1977.

> requests are to go up a level. There is another consequence of level switching in mathematics that is sex related: "Moving a girl down is usually big trouble from the parents." A counselor and a teacher and the department head made similar observations on other patterns of girl students in mathematics learning. The best students sometimes do not like mathematics. While boys who do well in mathematics can be counted on to like it, this is not the case for girls. Some of the highest performing girls have confided to the counselors that they really don't like mathematics. Such comments are not made for the benefit of the boys (who are not there) and are not related to whether they like the teacher(s).
>
> Another teacher said, "I have the feeling after 23 years that my top boys understand mathematics better than do my top girls even though they [girls] will score better." (Can't give reason. Not sexist.) Whatever the case or reasons for such interest and/or competence, the lowest levels are populated more by boys than by girls, with a disproportionate number being Black and Mexican American.

Several methods of increasing the participation and achievement of girls in science and mathematics have been suggested. Career education and counseling services might be improved. Teachers might be made more aware of the subtle ways in which they influence behavior through their differential treatment of boys and girls. More mathematics and science courses might be required, forcing girls to take them. Teachers might be helped to overcome their own anxieties and weaknesses. Female mathematics and science teachers might serve as role models, helping reduce the "male domain" stereotypes. All-girl classes which would eliminate girls' anxieties about competing with boys and prevent the occurrence of typical sex-role behaviors in class (such as the RIVER ACRES (p 1:87) girls who read laboratory instructions while the boys did the work) have been suggested; however, Fennema says that this must be approached with extreme caution because its long-term effects might be negative.* Available information suggests that the current emphasis on upgrading women's roles in society is helping to redress the problem of differential achievement; however, it seems unlikely that those social influences will be sufficient by themselves to eliminate the differences in the near future.

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*Fennema, op. cit., 1976, p. 51.

Ethnic differences. The education of ethnic minority students (primarily black and Mexican-American) was a major concern at several sites.* Several schools had experienced increasing minority enrollments, and some of the case studies include descriptions of the perceived consequences. This excerpt is from the WESTERN CITY case study (p 7:23):

> As Anglos have been leaving the neighborhoods close to City High ("White Flight"?), Blacks and Chicanos have been moving in. This has had the general effect of decreasing scholarship and lowering of standards. Some teachers and administrators have also indicated that the situation will probably get worse before it gets any better. On the other hand, there is no evidence to indicate that this is really the case. The only evidence that is available is that there has been a steady increase in the number of ethnic minority members attending Western City High and an attendant decrease in science--chemistry and physics--enrollment. The local community college reports that while in 1967 the City High School matriculation rate to the college was 62%, the rate for 1974 was 47%. The community college also attributed the loss of enrollment from City High due to the end of the Vietnam War and other factors.

And from the RIVER ACRES case study (p 1:4):

> The general increase in enrollment has included an average annual increase of about 300 minority students for the past four years. Lower student achievement for minority students--principally Mexican-American (20%)--and Black (10%)--when compared with 70% Anglo students, has been noted over the years at all grade levels. The minority student achievement patterns are accompanied by high dropout rates and a "lack of motivation for traditional and remedial school programs."

And from our 100% black high school (p 9:11) in ARCHIPOLIS:

> A natural quasi-controlled observation opportunistically offered a demonstration of how a class of students influences the performance of teachers. The same social studies teacher taught both the "top rated" ninth grade class, and the ninth grade class that "seemed never to bring anything off right." The latter was a mixture; eight to ten streetwise kids; a few already accomplished entrepeneurs of the ghetto; a few serious students; and the majority, youngsters whose most common response to school "opportunity" was lethargy. Even lively, hard-working, articulate Ms. Matlan, with valiant efforts, could not seem to change their momentum. Pep talks. "All right. Class 9-28 is good, but you can be, too!"

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*The ethnic/racial composition of each of the CSSE school districts is shown in Table II (p C:14) in the Methods section of Booklet 0. The representation of minority populations in most CSSE schools was greater than in the district as a whole (p C:15).

Lack of motivation was noted as a problem also in PINE CITY, where more than 60% of the students were black (p 6:15):

> *Motivation really is the big problem here. I don't understand why it is, but looking at it rationally, students in the northeastern part of the United States consistently score higher on tests of academic motivation than students in the South. Yet I am sure our students are just as able.*

There was some concern in RIVER ACRES that Black and Mexican-American children are rarely in top-level achievement groups. They were in groups 3 and 4 (p 1:87):

> *When you go to a lab with a 4 (group) you have got a problem. It is better to do teacher demonstration. It is ofter better because you get the right results and they almost never do. They are so busy breaking beakers they never get anything complete anyway. So at the very least the teacher can show them how it does work if you want to do it right. Their attention span is so short they will be wandering off doing something else if you don't watch them closely. They'll really destroy your lab if you're not careful. Over 60% (of) level 4 are boys. Black kids get assigned to level 4 mostly because of a reading problem, next because of a math problem; next because of a discipline problem; and last because of a science problem.*

A retired teacher in RIVER ACRES viewed the education of low-achievement students historically (pp 1:85-86):

> *Before 1974 they were all in special education, since then they have been phased into the regular program. They just can't read and the new words do "keep coming" in science. But it isn't only a matter of scientific terms. I once asked all the kids how many had ever been in a cave? Do you know what it smells like? Over 90% of my poor kids had never been underground at all. Never below ground level; think of it! Meanwhile a lot of my upper (social class) kids have rock collections, have visited mine shafts, have had more first-hand experiences than most of their teachers.*

There were comments in the RIVER ACRES case study about the lack of remedial programs (p 1:66):

> Last year Eastland had a remedial reading and mathematics program paid for by federal money. This year it is reading only. When the program was in effect bureaucratic red tape got in the way of instruction for some children. "We had to kick some special education kids out of Title I mathematics remediation (reading/arithmetic) because of the 'no-kids-in-two-federal-programs' rule."

And in WESTERN CITY (p 7:7):

> Of the three main ethnic groups in the W.C.S.D., the Chicanos are the ethnic group that exemplifies the loss of mathematics achievement. By the end of the sixth grade, the Chicano group is reading almost two years behind grade level and over one year behind grade level in mathematics. Whether this is due primarily to language difficulty is not known but there is some evidence that indicates part of the problem:
>
> > *. . . just arrived from Mexico. We have him sit over there because no one can understand him. He hasn't learned to speak English yet. When he gets to the point where he can understand English, we will start him on math and some of the other areas. . .*

There are some bilingual education programs, but surely not enough. In RIVER ACRES (p 1:4):

> There are a few bilingual teachers in a few of the elementary schools. Although I observed a first grade teacher (Anglo) conducting school in Spanish, the district does not have a bilingual education policy. The principal of an elementary school can decide to offer part of the school program in Spanish.

Observations of a high-achieving group of students in ARCHIPOLIS' inner-city school, however, provided a more optimistic portrait of minority education:

> . . . I saw this "peach of a class" in general science, several working on science fair projects, and another time in math class. But my most striking encounter with them was after the social studies observation in the science room when I suddenly realized that several of the students were speaking Spanish to one another. I began to talk to the four or five boys, two in particular, in Spanish, to find they only had been studying it for six months; had never been in a Spanish speaking country, nor neighborhood, and were being taught Spanish by the math teacher! In a school world in a very poor urban neighborhood, this intellectual "oasis" had taken shape. How teachers responded and worked with them one could get some idea of what enthusiasm and effort teachers were capable of had they not been beset with student conduct and heterogeneity problems.

Chapter 16

THE TEACHER IN THE CLASSROOM

Girl: Where are you going? -- to math?

Boy: No. I'm going to aftermath!
Man, have we got that teacher going in circles!

In numerous penetrating studies* the life of the classroom has been described and in other persuasive studies,** the necessity for teachers to be enthusiastic and full participants in any effective program of curriculum change has been documented. One thing support agencies such as the NSF still have not come to know, however, is how teachers decide things. We need, not just the characteristics of classrooms and general policy for innovators, but understanding of detailed processes or mechanisms which lead teachers in one case to adopt an idea or a set of materials enthusiastically and, in another, to reject such proposals as "unworkable in their situation."

What we learned from many of our direct interactions with teachers in this study was that they were not just taking a "sour grapes" attitude about curriculum improvement. They were not cool toward innovation just because they were not the ones invited early to participate in curriculum development programs or institutes. They had been telling anyone who would listen that they know what will work in their classrooms, and what will not, and that they know that most of the heralded innovations will only work in exceptional situations.

What it is that will work appeared to be largely an unarticulated knowledge, somewhat but not highly idiosyncratic to the teachers themselves. It involved basic goals and responsibilities teachers assume which most curriculum authorities and instructional technologists do not consider primary. It involved a style of teaching and set of beliefs about what good teaching is which are acquired early and contribute to the functioning of a social system that is--even in many of the most liberal communities--conservative and resistant to change. Teachers referred to their students as needing certain kinds of material, certain prior conditioning before they could meet expectations of others, and certain ways of being handled to get them to work. We noted that they did not always express these ideas clearly, but we also noted that they knew that educational specialists reject most of them out of hand.

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*For example: Louis M. Smith and W. Geoffrey, The Complexities of an Urban Classroom: An Analysis Toward a General Theory of Teaching (New York: Holt, Rinehart and Winston, 1968); and Phillip W. Jackson, Life in Classrooms (New York: Holt, Rinehart and Winston, 1968).

**Especially: John I. Goodlad, Frances M. Klein and Associates, Looking Behind the Classroom Door, 2nd ed. (Worthington, Ohio: Charles A. Jones, 1974); John I. Goodlad, The Dynamics of Educational Change: Toward Responsive Schools (New York: McGraw-Hill Book Company, 1975); Ann Bussis, Ted Chittenden and Marianne Amarel, Beyond Surface Curriculum: An Interview Study of Teachers' Understandings (Boulder, Colorado: Westview, 1976).

In analyzing various kinds of information from our sites, we took those remarks seriously. We attempted to search out what it was that goes on between teachers and their students that convinced teachers of these widely held beliefs. This quest frequently involved taking a sympathetic approach to practices most scholars of the discipline and education specialists regard as serious distortions or misuses of the subject matter and to purposes they thought the subject matter should not be asked to serve. The attitudes many teachers had of reluctance and even hostility toward the best efforts of scholars to help them, began to make a certain sense when we tried--as participant observers particularly in one of our research sites--to adopt the teachers' positions ourselves.

This quest was one of the most difficult we undertook in connection with the general goal of describing what was happening in classrooms. We were not able to make much progress on it until the site visits of the spring of 1977, when most of the data-gathering by our field observers had already been completed, and it was not until the summer of 1977, after most of the individual case studies had been written, that site visit observations relevant to this problem were largely appreciated. When we then looked into the case studies themselves for explicit confirmation we usually did not find it. There were supportive statements but not as much confirmation as any of us would like. The field observers usually were working on the curricular issues deemed important at the sites, in the classroom, at the school building level, or, in one or two cases, at the district level--and were not usually attempting to probe deeply into the individual teacher's belief system. However, the field observers did make many observations of classroom practice which we can now interpret in terms of the perspectives that emerged from this quest.

We shall begin this assimilation and synthesis chapter with some of the most relevant of our site visitors' observations, then we shall turn to the CSSE National Survey, where some questions relevant to understanding teachers' belief systems appeared and finally we shall consider those portions of the case studies that can be understood in the light of what we have learned from the site visits. This chapter differs methodologically from the other assimilation chapters in the primary use it makes of site visit data.

In reviewing these data, we deal with a variety of problems: teachers' maintenance of classroom control, teacher's acceptance of the "givens" of the situation (what other teachers will expect of their pupils in later grades, for example), how teachers feel about themselves as persons and as professionals, what they think of the various support systems (universities, supervisors, institutes, textbook publishers, teachers' unions). Throughout this chapter, we try to keep in focus both the particular details of subject matter and materials that are useful to teachers for their professional goals and the particular details of subject matter and materials that interfere with the responsibilities they have assumed. Above all, we try to keep clearly in mind the image of teachers, largely working alone in personal struggles to select and adapt materials, to educate and control the allotments of young learners they receive from an increasingly skeptical student population. We hope that such progress as we have been able to make on this important task will stimulate others to study it more intensively in the future.

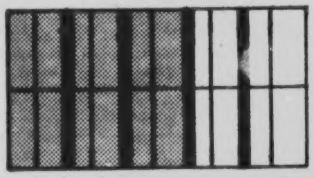
SOCIALIZATION AIMS OF TEACHERS

We begin with an excerpt from the report of site-visitor mathematician Hassler Whitney of the Institute for Advanced Study at Princeton:

> Basic math class, Mr. Blue: Work on adding fractions. (The junior high class seemed extremely like a fourth-fifth grade class I visited several times in Princeton). Ramondo was doing a problem just about as shown at right. When he reached the 1 ^{29}, he then wrote 29 below the 84 and added, "Is this right?" This is quite typical of what happens in any grade: trying to remember something somewhat like what you are supposed to do.

$$\begin{array}{rr} 52\,\frac{2}{5} & \frac{12}{30} \\ 21\,\frac{5}{6} & \frac{25}{30} \\ 11\frac{7}{30} & \frac{7}{30} \\ \frac{1}{2} & \frac{15}{30} \\ \hline 84 & \frac{59}{30}\ 1\,{}^{29} \\ 29 & \\ \hline 113 & \end{array}$$

> Loraine had written $\frac{3}{5} = \frac{12}{20}$, and asked me if that was right. I drew a rectangle, divided it into fifths, and asked if she could show me three fifths of the rectangle. She shaded this. I then asked if she could cut the rectangle into twentieths. With some trouble, she cut each piece in half, then in half again. Now she found that she could count the twentieths, and got twelve. She expressed new understanding. (Of course, I was using a remedial technique that is supposed to give understanding, and does something in this direction, but by itself is not lasting--it was too much from me, not from her; I wanted to see if she could get the sense of what meaningfulness could be. She is going into nursing school; understanding is much more important than algorithmic knowledge here.) (Emphasis added by CSSE staff.)



> I talked to her a couple of minutes to see if she could get a sense of the need for and meaning of security, so she would not need to have assent to each thing.
>
> This is one of the greatest problems of present day "back to basics," as I see it. The attention goes so thoroughly onto doing the right thing, hence learning and remembering, that there is not at all sufficient time or energy to grasp what is happening in your own terms. Then with teacher or helper not around, students feel quite insecure or lost. In particular, they do even more poorly on basic skills tests, after they have been away from the work for a period, than in

> the more traditional classes. This is certainly true very largely, though some are better than others at memorizing and following rules. Even these are most commonly unable to solve story problems, except more or less by rote, if in a familiar form.
>
> Discussion with Mr. Blue: He has already spoken of basics as the greatest need. I spoke of my experience with Ramondo, and how understanding might help. His reaction was to get turned off; he had probably had too much of this kind of talk, and long experience in failing to see better results from "discovery." "Drill it into them" was his comment; he had learned that this was the only effective approach.

Hassler Whitney here recognized one of the key dilemmas for a teacher: whether to focus on the students' long range needs or their immediate needs. Mr. Blue knew that there are students who survive freshman algebra and geometry, who finally come to operate meaningfully on fractions. But his students were unlikely to get that far because they could not seem to grasp the meanings of operations on fractions. His two tactics seemed to be (1) trying to motivate students to try harder, and (2) trying to get elementary schools to set higher standards for arithmetic achievement. That is, Mr. Blue and teachers like him felt they have to deal with the immediate problem rather than taking a more basic long range approach. Whoever one might sympathize with most the absence of any relief is tragic.

Mr. Blue did not seem to consider that fractions in "basic math" might become at least a bit intersting in their own right. The traditional mathematics world, the university mathematics department where he studied even the technical world of the hospital, the pharmacy, the grocery store, where the English systems of measurement once demanded facility in operations on common factions, have almost entirely ceased to do so. What was also clear was that the models Mr. Blue had in his profession (e.g., the senior high school advanced math classes and university classes) did not encourage him to move in the direction Whitney saw as desirable for the educational development of students. Whitney and Blue both knew that spending more time with physical models of fractions alone would not do the job. Perhaps both would have agreed that making mathematics interesting would require a new atmosphere for both teacher and pupil, an atmosphere that would require each to relax his concern for getting that one next page of arithmetic done correctly. But standardized tests, and the tendency some students have of taking advantage of any relaxation to mock the school system, would not go away. So the tactic of making mathematics interesting did not appear promising to either in this situation.

Numerous remarks made by teachers to site visitors suggested that the demands of classroom teaching inhibit change in the classroom. A young teacher said:

> *What I think is very sad about first year teachers is they're so disappointed after they get into the classroom. [Vigorous laughter from other teachers present.] You have all these neat activities and good ideas but you cannot work in the classroom-type situations we have and have these things be successful . . . By the end of the first year, she's made a lot of revisions and things aren't nearly as fun as they were, and by the end of the second year she's thrown out a lot of them.*

The teachers we talked to had an internalized concept of what the constraints in the classroom were and why new methods, ones that assume a different pedagogical framework or expository style, were likely to fail.

In terms of in-service training, including summer institutes, what many teachers wanted was not a major overhaul of their conceptualizations but a chance to talk with other teachers and collect some "gimmicks" that could be incorporated into their existing schemata:

> *The institutes that I've attended that have been really worthwhile are the ones that provide a new bag of tricks or an elaboration of a bag of tricks . . . Most of the people . . . want to see some things that can be applied in the classroom. Like this anthropology curriculum project--a fully and completely integrated program. They come in with the skulls and bones and artifacts and site maps and the film strips and records. After you've gone through that material a couple of times, you can elaborate on it yourself. I think these are the kinds of things teachers are looking for . . . No additional courses--I wouldn't be interested in that. But if someone were able to provide some techniques or some new strategies, I think that would be interesting.*

This teacher seemed to be relatively flexible. Another attitude was reflected in the following:

> *For the most part, the newer teachers haven't really had enough opportunity to reach a state of despair about institutes because they haven't had enough institutes.*

An extreme reaction was that of the teacher who rejected all outside advice as "interference":

> *So much of what I've gotten in in-service training that I've tried to use either I haven't been successful or it hasn't worked out that I'm kind of in the mood now that I want to be left alone and clarify things for myself.*

One of our concerns was to understand the different perceptions of science teaching by teachers and the subject-matter specialists who attempt to help them with curriculum and pedagogical problems. One hypothesis was that subject-matter knowledge, as an end in itself (a common assumption of the academic community), got transformed in the school into a means of meeting the socialization demands of the school.

It was clear to us that the school had a set of social norms (ways students were supposed to behave) which conflicted with the norms teachers were taught to espouse in teacher training courses. Not only the education courses had dysfunctional norms: the liberal arts norms were essentially the same. A high school English teacher said:

> *When I got out of the university, I was very keen on intellectual problems; and I was terribly frustrated*

> *that I couldn't get my students to respond. Then, just when I had almost decided to quit, I discovered that I really liked high school kids. Now, I have no trouble getting them to think, because I can relate to whatever they are talking about and put it in some intellectual form; for example, into philosopher Stephen Toulmin's forms of argument.**

Frances Stevens, writer, and professor emeritus from Leeds University, and frequent visitor to U.S. schools, made some very interesting observations. After visiting the social studies departments of a junior and a senior high school at one of our sites, she wrote:

> One consequence of pedagogical authoritarianism is a simplification of the teaching-task. As the principal of the junior high school rightly said, "Teacher-centered teaching is the easiest form for everybody."
>
> "You could find," he went on, "thirty individual programmes for thirty children--but it's a hell of a lot of work. When 'open education' is really well done, the degree of structure is very much higher. . . . Yes, in the classroom here the teacher is the authority."
>
> A disciplinary curriculum and authoritarian teaching are, as the principal said, easiest for everybody. Easiest, that is, in the situation in which they succeed. This remark, though it sounds either tautological or cynical, is not. I mean that, given a curriculum which looks sufficiently like that on which the parents were brought up . . . ; given students who approve of their own social milieu and traditions (approve, that is, in the sense of largely taking them for granted), and are therefore strongly motivated to acquiesce and to succeed on the school's terms; given teachers who believe in the firm outlines--outlines, not detail--of the traditional curriculum, and not as mouthpieces and its authority; given that the larger social environment is fairly stable; given all these things, authoritarian education is easiest. A large number of "givens" but all were present in the situation I observed.
>
> My last "given" may seem questionable. "We are the little boy with his finger in the dike," said the high school history teacher. . . .
>
> When the teacher's authority is associated with a disciplinary curriculum there are two reciprocal consequences. First, the teacher authorizes the curricular content (not the same as subject-matter) through his or her unquestioned commitment to the "structure" the students are to "identify." Secondly,

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*Stephen E. Toulmin, The Uses of Argument (Cambridge: Cambridge University Press, 1958).

> where this commitment is not wholehearted--even though to question it may be ultimately indicative of greater independence and inner strength--the teacher's personal authority is threatened, especially if the total situation is dominated by an articulate and powerful parent body. Both these consequences were clearly observable in the school visits.

Frances Stevens thus indicated that ideological disputes about pedagogical style were not as critical as the personal problem all teachers face: how to maintain student respect and willingness to work. Teachers often appeared to use subject matter to demonstrate their personal competence. They testified that something more than showmanship was required, namely, wisdom in handling tricky situations, e.g., where students challenged accepted mores by playing one peer against another.

How is this wisdom acquired? Who writes the book on it? It is rarely discussed in educational psychology courses, almost never in science methods courses. In the best college preparatory high schools some teachers become "wise" to the students slowly. In "inner-city" schools, a quicker response is required. Some teachers apparently come by such wisdom naturally, but most struggle to develop it on their own. Frances Stevens continued:

> It was observable that, outside the curricular situation teachers' authority and status vis-a-vis the pupils was variable, and that some of them seemed to be a little unsure of their social position. One teacher, magnetic in personality, could almost certainly "hold" his students in or out of the classroom, even though he might choose to do so on a very loose rein. Another, dogmatic though his professions were, evidently doubted his capacity to keep his students in class on the verge of a holiday. A third, efficient and dominating in class, had, I think, revealed some uncertainty in her personal relationships by setting a class to make a composite portrait of her through a checklist of qualities. . . . (Has a good sense of humor; knows subject and sticks to subject in class; has a good reason for giving punishment; has irritating personal habits, etc.) Yet another reported, revealingly, that she had said to her students, "I'm not your servant;" this last teacher was also visibly anxious to ascertain from the observer some hints of the students' reactions (in interview) to her programme.

When teachers criticized pre-service and in-service programs--as they frequently did--many appeared to have in mind a personal struggle with the act of teaching. To whom could teachers turn for help on such problems? If these problems were even a small part of the problems teachers had to work out alone in their classrooms, then it is small wonder they were not very articulate--as they were not--about what they wanted from their training and did not get.

Three Reference Poles. We saw the science teacher working conceptually as if influenced by three poles: (1) the ethic of scientific inquiry, (2) the "ideal" science teacher role, and (3) socialization responsibilities. Two of these are apparent in the following report on an advanced placement biology class prepared by co-director Jack Easley:

> The classroom was dark for the showing of a short, silent film of the growth of plant shoots filmed by time-lapse photography. The teacher explained that the problem was "phototropism." The cells of the animated sequence were drawn in, so that students had a schematic representation of the different rates of growth on two sides of the oat shoot. What was unclear from the animated diagrams was whether there were more cells on the rapid growth side or whether these cells were simply getting larger. That is, the question several students seemed to be getting at was whether the hormone that stimulated growth, or inhibited it, affected the rate of cell division or the size of the cells or both. The teacher was evidently not prepared for the question, having been focusing on the technique by which the hormone was abstracted and applied to the shoots. I observed that the students did not press the question when they found the teacher's response unhelpful. I am reminded of so many similar situations and of the tremendous number of things the teacher has on his mind when in such a situation. There is the projector, which wasn't working perfectly, the darkness, which prevented his seeing the students, the visitors (two of us), and the points he was going to make in future classes, labs, or tests about this experiment. You have to push the class on to the points you want them to get, so you can only give the illusion of scientific thinking, and a scientific attitude may get lost.

Here we see the conflict between scientific inquiry as an intellectual discipline, the pole of reference of most science education and curriculum specialists, and the teacher's obligation to direct student work: to emphasize what they should be expected to remember, what they would need in subsequent courses. The teacher had to attend to what they would need for the advanced placement tests used in deciding whether, once in college, they would get four hours credit for this course or not.*

Any school is a social system. Teaching an advanced placement course was near the peak of professional status in that social system--not something to be risked by engaging overlong in an interesting intellectual dialogue. It might reveal a spot of ignorance. It might jeopardize one's standard.

Most teachers had not had training that would make them respond "instinctively" to the fruitful observation or the penetrating question of a thoughtful student. They were trained in the same undergraduate courses that prepare students in universities for graduate studies. These were seldom research seminars of the sort reserved for doctoral students--to explore areas of doubt or ignorance. How could we expect them to conduct lessons in a comfortable inquiry approach? Teachers know when the student strays beyond the path along which they themselves have traveled, and depending on personal risk-taking tendencies, may either pull him or her back onto the path or encourage the exploration further.

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*Advanced placement courses were strongly supported by many of the more academically ambitious parents and students of the school.

It is important that we look at other models of science teaching which teachers aspire to, for there we can see "distortions" of learning and "distortions" of subject matter in the hands of teachers primarily pursuing socialization goals. We perhaps can learn more of what the more authoritarian (in an academic sense) teacher aspires to from Frances Stevens' observations:

> It must be made clear that what is seen as the essential core facts and disciplines is not to be identified with a parroting of information. The teacher interviewed in the junior high school insisted that he was concerned not with facts, but with the relationship between facts. In the high school, the history teacher said: "The outset of the high school career, the facts themselves are not nearly as important as the qualification and finding of facts. The subject-matter for our freshmen and sophomores is not the pedantic knowledge that the Magna Carta was signed in 1215, but the knowledge of how you would go about deciding that this is an important document. Is it primary or secondary? You look at the mindset of an author, the time at which a document is written, and so on. By the end of the high school programme, the student should have learned a disciplined approach to historical material. From knowing how he moves towards knowing.
>
> Students taught--and, in these two schools, for the most part very efficiently--within a conventional and conservative framework are following two curricula. The first is the body of established knowledge and procedures to which the learning-encounter is intended to be instrumental. The second is the personality, which of course includes individual preferences and value-systems, of the teacher, communicated in the learning encounter. Students of the teacher just mentioned must have learned, besides the facts and processes contained in the syllabus, his passionate concern for the careful discriminations and unremitting logic of historical method, as well as his commitment to an austere discipline that shuns delights and lives laborious days.

This seemed to be at the heart of the teacher's struggle, a struggle with which they get little outside help.* It reflected and grew out of struggles with their own studies or at least that part of their studies in which they could take personal pride. It involved an intimacy, a sharing of pride and value-commitment, with their students, within the context of instruction in math, science, or social studies.

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*Worse still, the few minutes they could devote to this struggle were increasingly conscripted for the formalization of instruction, such as objectives-writing and testing.

Frances Stevens continued:

> The very givenness of the ostensible curriculum can release the power, sometimes hardly perceived, sometimes very consciously felt on both sides of the learning-encounter. "I search out materials that reflect my own value-system. . . . I think they know how I feel about these things. . . . I guess that's the most important thing. . . ." The reciprocal of these words from a teacher is (from one of his students): "He teaches the way the kids like--he puts himself in their position--he knows our feelings."

Certainly not every student shared in the mutual (teacher-student) tuning of values and feelings illustrated in this quotation. But the power she referred to identified another pole of reference--the socialization pole, for the relationships involved in socializing youth are more often felt than explicitly known.

After observing a junior high school teacher-team discuss difficult cases, Frances Stevens reported:

> There was a discussion on whether a girl, weak in English, could be regarded as "having completed the year successfully." Her English teacher rather grimly reported a succession of low passes and failures in her recent grades. Though this teacher did not assert herself verbally, her reticence implied that she would be very reluctant to let any student get away with unsatisfactory work too easily. A student was said to have shown distinct improvement in his work of late, especially in science, but "he is not being dangerously encouraged," added the science teacher with a slight smile. A discussion of kindly sternness took place about a student who, all agreed, had not made the grade during the year. Though his work was below standard, his attitude and behaviour had been quite satisfactory, and all were anxious that he should not be humiliated at the graduation ceremony. . . . The longest discussion concerned . . . a student . . . who had been suspected of stealing on more than one occasion and had been obscurely threatened with punishment, and had subsequently been detected in manifest "thievery" and at a time when other students were aware of it. . . .
>
> Conducted in civilized tones, discussion of this whole situation was nevertheless full of emotion; and, though the personalities of the participants (teachers, principal and vice-principal) differed considerably, there was a great deal of shared aggression, first signalled by the use of the word "thievery" (in preference to "theft" or "stealing"). The discussion rested on two bases: an abstract principle of retributive justice (thievery must be punished), and practical considerations of social order. (On the second, the principal produced a persuasive argument: in his experience, he said, suspension had seldom or never improved the "behaviour"--the word is revealing--of the student, but had almost always produced an improvement in the behaviour and attitudes of ninety-five per cent of the student community.)

This discussion, like others occuring in most schools, may seem far removed from the classroom interaction relating to the subject matter of science, mathematics and social studies. However, it was just this sort of concern--to reward sincere effort, to avoid over-rewarding students for modest accomplishment--that directed the course of instruction in the science classroom, as in all the classrooms.

We became alert to the fact that most teachers felt they had to use the instructional time and materials in order to socialize students into the social order, and that this was often where problems with proposed reforms in content or method arose. But in this case, as the observer noted, there was a problem with the way school work was regarded.

> In the rather complicated argument which gathered about this last case, there were two discernible threads: First, that suspension would not be a sufficient punishment for the boy if he were allowed to make up his school work (as his mother had requested); and second, that, as he was an idler, missing school would be for him a sort of holiday, and thus a reward rather than a penalty. . . . Eventually it was agreed that he should come to school during the two days of holiday on which, of course, the other students would be absent.

The enthusiasm teachers had for positive responses from "weak students" was such an important part of their concern for socializing students that another example (besides the case of the student whose English was poor) is worth considering. Frances Stevens quoted a history teacher as follows:

> "They're so much geared to giving answers," said the teacher (alluding to the answer-question approach in the class I had observed), "that I thought I'd give it to them the other way round." How much they were indeed "geared to giving answers," was shown in another part of the same lesson. In answer to the question, "What were two of America's big problems in the post-World War II years?", one boy said, "The world didn't have enough love." This response provoked a gale of laughter from the class and slightly nonplussed the teacher who commented mildly that this was connected with a lot of problems. When I later referred to this interchange, the teacher's face lit up. "Oh, that was one of those beautiful moments," he said. "It's like music--you just know when it's right. He's not very bright and did you notice how David [a bright student] put him down? But I think they know how I feel about these things--I guess that's the most important thing." Was it? I deliberately recalled the incident again, when interviewing one of the students. The boy laughed. "Oh, that!" he said. "He just said that because he didn't know the answer. He didn't take it from where he was supposed to. He made that up."

Clearly, students were making a rigid system of the standard way the school rewards them. How impotent is this teacher's desire to support certain values against the social pressure to learn what was in the book and how to give it back. The music of a creative response ringing in the teacher's ears did little to charm the students.

Frances Stevens went on to another telling point about teachers in general, (not that particular teacher):

> I have already observed that the work in American history depended, appropriately, on considerable reading-assignments. With caution, however--since there was not time to go into the matter at all thoroughly--I suggest that, unless the teacher was both exceptionally well read and also subtle in guidance, this meant an excessive reliance on the textbook.
>
> Such reliance certainly made for security and precision. But textbooks are written by people, and are often digests of other books written by other people. The book in the hands of the student may be many removes from the historical event or situation; and the distance is not necessarily lessened by much inclusion of "course materials." In a sense, the better the textbook, the worse: I was able to have only a cursory glance at the book on which an eighth-grade class was being questioned; but I noticed that, in its survey of post-war Europe, several Iron Curtain countries were mentioned as being "occupied" by the Russians, and that a series of quick-fire answers to this effect was accepted by the teacher. In what sense occupied, and for how long?

Most teachers questioned about their philosophy of history or historiography had little to say. Their concern was structured by the circumstance of their own classroom. Many seemed content to see to it that students knew the textbook and perhaps could discuss current events in the light of the assigned readings. Criticism of the textbook was an interesting topic to only a few teachers and to an even smaller percentage of students. The scientific inquiry pole of teacher reference is evidently not strong enough to overcome the pull of the other two, the schools ideal for teaching and the great demand for socialization.

A Vignette on Socialization. The moral importance some teachers attached to having children persistently trying their best (illustrated by a teacher avoiding "dangerously encouraging" a boy doing poor work) was also illustrated in a junior high school pre-algebra class. The game GUESS MY RULE was being played. Jack Easley's vignette also succinctly illustrates the conflict in the purpose of the game from the point of view of experts in mathematics education and against the socialization responsibilities taken for granted by the teacher.

> Whoever has the chalk calls on a volunteer to make the appropriate next move: (1) making up a secret rule and giving a pair of numbers such that the rule takes you from the first to the second; (2) guessing a second number when given a first; (3) guessing a first number when given a second; (4) formulating the rule for testing against the table of number pairs accepted by the rule maker. Figure 16-1 illustrates three of the rules and the tables of the nearly dozen rules that were created and guessed during the class. As the game progressed, the rules became more complex, which means that the probability of becoming stuck tends to increase for each player as the game goes on. (See Martin Gardner, "Mathematical Games" Scientific American, 237 (October 1977): 18-25, for a discussion of this point.)
>
> This game was quite unlike most arithmetic exercises from textbooks or from work sheets. There the probability of getting stuck decreased as one worked more exercises. In several ways the game did not fit well in the socializing function of school mathematics--trying your best to do what you are told to do. This came out clearly in the following three instances:

Δ	Π
2	7
3	10
4	13
0	1
10	31

$\Pi = 3 \times \Delta + 1$

Δ	Π
49	8
1	2
3	
17	
16	5
25	6
36	7
81	10
144	13
400	21

$$n = \Pi - 1$$
$$\Delta = n \times n$$
$$\Pi = 1 + \sqrt{\Delta}$$

Δ	Π
7	55
2	5
3	11
0	-1
10	109

$$\Pi = \Delta^2 - 1 + \Delta$$
$$\Pi = \Delta \times (\Delta + 1) - 1$$

Figure 16-1. Three completed tables and equations from the game GUESS MY RULE.

The teacher had been observing that several students, whom she later identified as unmotivated and as lacking self-direction, were simply not playing. They were just sitting the game out, so she broke into the game and called on one of them. When the student went to the board and put a number in a column and it was called wrong, she said, "Well, try again." However, at this point the game had changed subtly, and numbers were being guessed for the left-hand column with no numbers in the right column. In the center table of Figure 1, we see the "3" he wrote and can understand what had happened to the game. The left-hand column now had to be filled only with perfect squares, at least the boy who had made the rule was not allowing any others. The boy, called summarily to the board, said, "But I don't understand what is wrong with "3". I don't know what to do." He had a double reason for being stuck. He didn't know the rule, or at least didn't know that it involved taking a square root, which hadn't been studied, and he couldn't imagine why now suddenly putting an arbitrary number in the left column was not allowed.

The teacher, however, persisted forcing what developed into a beligerant stand-off, saying, "You can't just quit. You have to keep trying."

After finally giving up on this apparently stubborn student and returning to the game, which she seemed to have forgotten, the teacher got stuck. She put the 17 in the left column, evidently getting the adding (or subtracting) 1 ahead of the square rooting. The students who, by now, had guessed the rule were quick to help her out, although none had dared to help the boy who was stuck. (Later she explained to the observer that she thought it was a good lesson for students to know that even teachers can made mistakes.)

This was not her only opportunity to exhibit being stuck. Having essentially taken charge of the game now and, perhaps needing to get back to the mathematical aspects, she volunteered for the function number (3) formulating the rule. Her efforts to write a rule on the board were all quickly proved wrong by the students using the examples of number pairs. Finally this observer offered a hint--that she try two equations with a linking variable. This got her "unstuck" and she wrote the two equations shown above the line at the bottom of Figure 1.

After another rule was made up by a student and eventually guessed, (right hand table, Figure 1) the bell rang and the teacher hurriedly assigned the task of thinking up more rules so the class could play the game again tomorrow. As the pupils were leaving, however, two boys approached this observer and showed him single formula rules they had written for the previous case. Both used the radical sign, which the class hadn't experienced, and one was in fact correct. (Below the teachers' pair of rules in Figure 1) For some reason, perhaps because the radical hadn't been introduced

> officially in class, they had been unwilling to offer their rules to help the teacher when she was stuck on the rule formulation. Of course, another factor was lack of confidence in handling radicals. Or perhaps they had their hands up, but simply didn't get called on by the teacher.

There is much in this vignette that makes it clear why this particular game is not compatible with the teacher's sense of responsibility. However, Jack Easley's conversation with her during her free period later the same day revealed even more:

> She remarked right away, apparently aware that the stuck pupil at the board was a scene that needed explaining, that there were several students who had not developed enough personal resolve to tackle their work when the going got rough. "I don't know what's going to happen to them," she said, "but I can't give up trying to get them trying harder." "What if they don't understand?" I asked. She replied, "I can't accept that as an answer. They have to learn to keep trying."
>
> I asked her how often it happened that she and the students cooperated in solving problems helping each other as equals, the way they did when she had put the 17 in the left column. "Now, about 10%" she said, "but in the beginning of the year, not at all. They first have to learn some math." Then she talked about how much she wanted them to realize that it was all right to be wrong, if only you didn't give up. Students confirmed this. Talking with six or seven of the students later, they told me that she did often make mistakes on purpose to see if they were paying attention. Some, however, did not appreciate teachers who made errors, on purpose or not, but others came to her defense, saying that she did not make nearly as many as another teacher they knew.

Perhaps mathematics educators who invent challenging games like this one could develop an entirely different kind of game that would employ more of the values the teacher wanted to emphasize.* Consider, for example, what she said about the ways the students treated each other:

> She spoke, also, about changes that were developing in the students of the class. Some of them had begun to mistreat each other in ways she found shocking, dropping jello-filled balloons on each other in stair wells, socially ostracizing certain children who were broken up and lost as to any possible reason. She had seen evidence of this cliquishness during the math game, in that active participation, raising hands, really trying, etc. was not related

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*Of course those people who invent games and curricula are bent on socializing students too, but in different directions than most teachers are.

> to ability but to social group. She felt she had to fight this with everything she could, and would apparently have welcomed a game or other activity that would have broken down cliques. It reminded me of the attitude of my parents, at my first teen-age party, who wanted to have us play mixer games.

Could it be that we were getting close to the principal mechanism that causes teachers either to reject an innovation or to modify it for their purposes in ways that its developer would not appreciate? Why similarly, was so little use made of hands-on materials after the first two grades, even though they are there in a corridor or closet nearby, or even displayed on a shelf in the classroom? Why, for example, were hand-held calculators almost universally banned from elementary and even junior high school classes, when studies* have shown real possibilities for improvement of arithmetical thinking through their use? Why, for example, had the terminology of the new math, introduced to clarify mathematical concepts, simply been added to those things that have to be memorized, or skipped entirely when encountered in the textbooks?

Hard Work is Good Work. Educationists are sometimes startled to confront teacher views paralleling the remark attributed to Minnie Woodson, a member of the school board of Washington, DC:** "The children don't understand that learning is not easy, that it takes application, they don't know how to apply themselves." This is also reminiscent of the teacher Frances Stevens quoted who said that a boy was "not being dangerously encouraged." Teachers said they could not change the fact that life is going to require youngsters to do a lot of things that do not make sense at the time, and that seem very difficult. Therefore, they argued there should be a significant body of learning at every grade level which is difficult, which may not make much sense at the time, but which has to be learned by every student.

It is interesting, in this connection, to consider how teachers and curriculum specialists might interpret David J. Armor's statement of educational goals (given as a basis for analyzing school and family effects on black and white achievement). He wrote:***

> *There are several quite explicit goals of this (common) educational process. (1) Foremost is the learning of some basic cognitive skills--reading, writing, and simple*

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*J. F. Weaver, Calculator-Influenced Explorations in School Mathematics: Number Sentences and Sensational Transformations I, II, Madison: Wisconsin Research Development Center for Cognitive Learning (ERIC Microfiche no. ED 123088, 1976); Marilyn Suydam, Electronic Calculators: The Implications for Pre-College Education (ERIC Microfiche no. ED 127205, 1976).

**In Newsweek, 12 September 1977, p.64.

***David J. Armor, "School and Family Effects on Black and White Achievement: A Reexamination of the USOE Data," in On Equal Educational Opportunity, ed. Frederick Mosteller and Daniel P. Moynihan (New York: Vintage Books, 1972), p. 171.

> *arithmetic--which are crucial for a person's full participation in modern industrial society. (2) Second, the secondary school provides instruction in various subjects--sciences, business, languages, etc.--which helps students to decide upon and prepare for further training in a specific occupation. (3) Third, the school at least implicitly attempts to impart attitudes to the student which help him to become an adjusted, participating citizen. These might include personal self-esteem, respect for law and the rights of others, and an understanding of the commitment to the national culture. (4) Finally, although not necessarily part of the educational process per se, schools provide some opportunity for aiding the physical and psychological welfare of children through the existence of health clinics, physical education, free-lunch programs, and counseling services. (indices added)*

While many curriculum specialists would stress the general educational value of course work (goal 2) more than its vocational value, teachers and schools appeared to us to have downgraded general education. The third goal (Armor called it implicit) appeared to us to be the dominant goal of teachers, permeating instruction that is ostensibly oriented to goal [illegible]. Curriculum specialists may complain that the goals of arou[illegible]s' interest in the study of their physical environment and the world of ideas has been omitted, but teachers seemed to reserve that for an elite group--those who have demonstrated achievement of the other four goals.

That lists of student goals poorly represent teacher goals was shown again by Helen Simons, site visitor from the University of London, Institute of Education. Summarizing a fifth-grade lesson she had observed* Helen wrote:

> What I find interesting about this teacher's style is her mixture of openness or acceptance of where the children are at, intellectually, and certainly about what she wants them to know. She left them to work out their own strategies first; listened to these; made sure that other chilren understood the method each group had used by interjecting questions like, "How did you get that?"; "Wait a minute. I don't understand"; "I don't know what that means." Then she evoked alternatives. If the children did not raise them (mostly they did) she would guide them to alternative ways of resolving the problem which she would then explain as she did with sampling which John had not used. She is always in control and stays with the question until she is satisfied that they have understood it. Her tone was consistent throughout. If children said nothing, that seemed to be O.K. If they appeared to be on the "wrong track" she would always say "O.K., All right, "

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*The whole vignette on inquiry, featuring an Elementary Science Study unit called "Peas and Particles," was presented starting on page 12:11 of this report.

> and try a different strategy to push them towards another method or the one she wanted them to learn. If someone gave the wrong answer in the same tone she would simply say, "no" and look for the right answer from someone else. There was no hint of criticism in her voice. Occasionally she did check up on those who appeared not to be paying attention by saying, "What did she say? I did not quite hear"; or, "Are you guys paying attention over there?" But I sensed this was more an attempt to get them to focus on the task and learn than to censure their inattention.
>
> What is obvious to an outsider is her commitment to the brightest. In discussion, the articulate and confident are heard first. There was John, who was asked to offer his explanation. When he had finished, she responded to one of the brightest girls . . . and was in the process of listening to an explanation of that girl's second problem (despite an objection from one of the other groups that not to hear them first was unfair) when the bell rang. She did not pay much attention to those who did not have the immediate reply. One senses that she gets a lot of intellectual excitement and reward from hearing the brightest talk through their discoveries or guiding them to understandings she thinks important.

Besides staying in control, we notice that working mainly with bright students raised a teacher's social status. The principal confirmed our site visitors' impression of the teachers' high prestige.

Still another interesting point came out when Helen Simons asked this teacher if she saw a difference between social science and social studies. She replied:*

> *I don't think I differentiate here. I think they overlap. I think . . . I guess social science would be concerned with teaching values . . . some important concepts about man and his environment whereas social studies is technically geography--rivers and their tributaries . . . and possible geographical concepts like that I think I would classify that as social studies. But social science you really have to learn about living in a community and having values. That to me is a science.*

Where would she place history? Her reply was:

> *I would say history is a social science too. You know why? Because if you are smart and you realise that mistakes other civilizations have made and you really try to avoid*

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*Reported earlier as part of the social studies section of Chapter 13.

> *making the same mistakes that is a science . . . our values come in there. . . . I think they [children] get values as you talk about these things [mistakes of other civilizations, differences in generations, etc.], but you have to talk to these children . . . I have a big chance to talk to them when they are out playing, I watch their reactions with one another. I think that's social science too--getting along with one another. And anything the guidance counsellor does with them is social science too.*
>
> And the lesson just observed? She hesitated and then suggested that when you come into a new area and have to decide what apartment to live in you estimate and decide on the basis of this or that observation of number of families, trees, children, etc. [Peas and Particles is about estimating numbers of things in large collections.] . . . what you prefer . . .
>
> *So I think there is a lot of social science there . . . being able to estimate and apply this and transfer this learning to something like that . . .*

This teacher, in linking science and human values, may have been closer to the ideology of the early curriculum project innovators, Zacharias, Friedman, etc. than to the positivistic, value-free research ideology taught in most university and high school science classes. Most secondary school science teachers we talked to probably would not support this teacher's view. Nor would elementary school teachers who prefer more "prepackaged" types of science programs. This observation seemed to provide a positive instance of a good fit between the personal, ethical, and preparatory aims of the teacher and the curriculum materials. Many scholars will feel that she has gone too far, however, in linking science and values--and is in danger of misrepresenting the scientific establishment view.*

One of the original aims of the CSSE study was to seek to understand the strong tendency for teachers to use worksheets, workbooks, or other "packages" of programmed exercises. Those that could be easily filled in, once an example was given, and which would be checked mechanically like an objective test, were found to have many adherents. Individually Prescribed Instruction (IPI math) was a typical example of this kind of program. We had a good opportunity to observe it in ALTE in two elementary schools. IPI mathematics was not the total program, and teachers were allowed to introduce whatever additional materials they wished. In the three elementary school mathematics classes and two study centers (where CSSE coordinator Jack Easley worked as participant observer for from one to three periods each) the same pedagogy was used whether the printed IPI sheets or a textbook were the source of the exercises. In his vignette (see the more complete version pp 15:9 to 15:12), Easley reported on different styles or math pedagogy:

> Fred leads the Wildwood project for the sixth grade, at Hilltop Sommerset School (where he teaches math to all sixth graders.) As he talked about planning for the week-

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*But the teacher would get support from Jacob Bronowski, Science and Human Values (New York: Messner, 1956): and André Cournand, "The Code of the Scientist and Its Relationship to Ethics," Science, 18 November 1977, pp. 699-705.

> long outing that was coming up, he mentioned that many students could get the right answer to questions about how many of this or that camping supply they would need, but couldn't do it systematically by arithmetic. "Those who were best in classroom arithmetic," he said, "often couldn't figure out practical quantities for a real project.
>
> Mr. Murphy, the principal, . . . described a "mini-class" he was teaching which involved setting up and manufacturing plant hangers made of string and wood. He said he was going to let the kids do everything, including buying the supplies, and he hoped they would have to borrow money and pay interest on it. He said that when they came across a practical arithmetic problem, he just let them struggle with it, and although it might take them two days, they eventually got it figured out to their satisfaction and his. . . .
>
> He admitted that, the way teachers worked in the classroom on math . . . the kids would forget the next week what they had been shown how to do and practiced this week. Such teaching had no utility, he felt. However, he had nothing but contempt for the junior and senior high teachers who demanded more math and reading skills than they were finding in their students. He grabbed his test scores to show me that his sixth graders were already doing far better than any junior high school math teacher had a right to expect.
>
> . . .
>
> When I asked [the principal at Mass Junior High School] if he could formulate the need for math teaching in such a way that all concerned would accept it, he pointed out that secondary and elementary school teachers see the world differently. Elementary teachers like to help each student do the best he can, secondary teachers like to cover the subject matter. I didn't ask about parents' views, but believe that teachers are mostly "locked-in" to parents' views of what should go on in school. Helping children think for themselves and understand math and science has a lower priority.

Although many different forms of school and classroom organizations were in evidence in the different classrooms we studied, one underlying system of operations was usually discernable. This basic system contained elements such as teacher-made assignments,* pupil focusing on teacher expectations,** teacher control of classroom activities, pupil demands that teacher give assignments and enforce doing them,* and teacher demands that pupils do their assignments.**

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*Gary Knamiller "Perceptual Frameworks for Viewing Children's Expressive Activity in a Science Learning Environment" (Ph.D. diss., University of Illinois, 1971).

**John Holt, How Children Fail (New York: Pitman Pub. Corp., 1964).

Preparing for Future Courses. In previous chapters it has been shown to no-one's surprise that many aspects of instruction would vary from one classroom to the next. For example, (1) instructional materials that provided the main organizing structure (a textbook, a set of work sheets, a cassette tape player, an electronic device to drill on arithmetic facts, a set of laboratory experiments, etc.); (2) whether the class moved along together or with pacing different for different groups of individuals; (3) whether or not homework was given in addition to school work, (4) whether any effort was made to relate the materials studied to pupils' out-of-school lives, to provide other organizing ideas, or to treat the subject "atomistically," (5) whether emphasis was primarily on memorizing facts, names, principles, and rules, or on acquiring skills (calculations, procedures, use of equipment, etc.), (6) whether evaluation of pupil learning was frequent or seldom, (7) whether the pace was such as to emphasize mastery or coverage, (8) whether pupils were allowed to help each other or required to work alone on their assignments, (9) whether students were encouraged to carry out projects as supplemental work or not, and (10) whether teachers were happy with the learning results or not. What was constant was that instructional materials provided the conceptual structure for the instruction rather than the teachers' or students' organization of thought about the subject matter. The principal reason for this now seems to us to be that the teacher's socialization goals--especially preparing pupils for success in later schooling--required that pupils learn to learn from materials.

We were persuaded that the majority of the teachers in our sites and even possibly in America would subscribe to the following beliefs:

A. Extrinsic motivation of students in some form is essential if students are to pay attention to their school work. Teachers should do what they can to motivate students, but many factors in the personal make-up and home situation of some students make motivation in academic subjects impossible.

B. Attention to directions, to the formulation of question, and to any presentations by teachers, textbooks, films, or other means is essential for academic learning. Teachers must help students keep attending to their tasks.

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*James Herndon, The Way It Spozed To Be (New York: Simon and Schuster, 1968).

**Louis M. Smith and William Geoffrey, The Complexities of an Urban Classroom: An Analysis Toward a General Theory of Teaching (New York: Holt, Rinehart, and Winston, 1968).

C. Students will learn most reliably when they are successful in carrying out assignments properly. Good study habits, note taking, and homework, are important. If homework cannot be done outside of class for various reasons, then teachers should provide time for it in school. Teachers should demand that work be handed in regularly.

D. Frequent testing of one kind or another (15:15) is important to make certain that the students have learned what they are supposed to. If they do poorly on tests, they should be encouraged to work harder on their preparation.

We noted how this basic structure of teaching beliefs and practices was influenced by the hot and cold winds of public attitudes, the management constraints of administrations, the social pressures among teachers, and differing expectations among students as to what teachers are supposed to do. So an innovation or reorganization at any one time may have featured self-pacing, grouping, and many other instructional variations. Teaching practices varied according to ideological and social attitudes, within and across communities and schools; and on the surface they bent like a reed, accommodating to winds that blew one way and another. Underneath, they were typically rooted in the four ideas above: motivating students, giving directions, promoting work, and getting feedback.

Jack Easley had this to say about his own experience as a univeristy teacher:

> When I'm working in the Sciences Tutoring Laboratory, I'm just teaching techniques and vocabulary and not the broad view of science I want to share. I'm "hammering it in" because I can see that those things are going to be necessary for my students to succeed in the courses they are taking. So, as I relate to each student as an individual, I think of what he personally needs right now. When I sit back in my arm chair and become a "philosopher" of science, I wish that all students could have the experience of philosophizing about science and mathematics. But neither they nor I are going to push that when there's an exam in two weeks on three chapters of chemistry.

Preparing students for the next year is an important socialization function in schools. Obviously there needs to be some agreement on what goes on in which grade, or at least what comes after what. In most of our schools long division was scheduled to come after two-digit multiplication, and teachers many places refused to let pupils start it until they had first mastered two-digit multiplication. (Although only one-digit multiplication is involved in long division, that's not the point.) It was generally believed that there should be social and professional agreement on what precedes what. Some kind of standards should be set. It had more to do with solidarity than with epistemology. Some "milestones"--which the school faculty would agree on--seemed to be necessary if teachers were to shepherd their students through the subject matter without suffering the complaints (or even scorn) of their colleagues. That the milestones be based on a valid rationale or experience was not necessary. A pluralism of pathways or different milestones for different youngsters became troublesome--even though nothing was more traditional and perhaps more basic than differential treatment of individual learners. The concern for uniformity and the difficulties with heterogeneity were dealt with back in Chapter 14.

Science educators and others who have tried to help teachers find a compromise between the standardized curriculum and the needs of individual children have not been of great help. CSSE staff member Charlie Weller wrote, in summary of his visit to elementary schools at one site,

> Most elementary teachers don't like science because of bad experiences in their own schooling--elementary through college. Most in-service workshops are ineffective because they transport teachers out of their environment into a different environment where there are plenty of materials, show them how to use the materials, and then send them back home to recreate what they learned without any support. The message from the teachers is: Forget it! Unless workshop instructors come to the teacher's own classroom, work with her children, use her materials, and show that children respond positively, there is little chance of success.

In response to his visit to another site, Charlie Weller wrote:

> The teachers, not of their own choosing, have been placed in the middle of all these issues and are unable to resolve them. They feel they work very hard and that little if any of their effort is appreciated by administration, parents, or students. They feel they are expected to educate kids (prepare them for college, for life, etc.) but the kids don't seem to care. They feel frustrated, they feel that colleges of education have not helped them at all. (Italics in original)

The hypothesis that made these data most intelligible to us was that teachers (partly of their own volition) are fixed into the social system that places demands to be met in order to avoid extreme social discomfort--demands which are incompatible with the demands of the scholarship system. They belong to both systems but they are much less at the mercy of the scholarship system. Scientists and other intelligentsia have little effect; parents and other teachers have much. What teachers do with subject matter (according to this hypothesis) is determined by how it sustains and protects them in the social system.

If schools and teachers were effectively isolated from societal expectations (as opposed to scholarship expectations) perhaps pedagogical and curricular reforms could be sustained.* Jack Easley had these responses to this observation:

> I feel the same social function of the curriculum in tutoring. It doesn't matter if I know a better way of organizing a given course or set of courses. I can't change the chemistry department and I have to help my client with his present course. That's challenge enough.

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*Teachers showed us no inclination to be so isolated--and what we took to be their intuition makes political sense. The schools divorced from the social control would probably contribute little to social understanding of youngsters.

> Although I have drawn up an interesting bibliography on tutoring in the sciences, I find the problems I confront daily as a tutor (unreliable attendance, not knowing what students don't understand, focusing on small points and missing the overall theory, etc.) are not treated in the literature. So I'm saying the same thing the teachers are --viz, educational research and theory has little practical value when you're working with students having difficulties. I have more hope than most teachers, because I can think back to earlier experiences of a similar sort and realize that, in those cases, eventually I was able to work out a useful connection with theory.
>
> Another point teachers make, at which I used to scoff, I've been able to discover in my own teaching at the university. I've heard many teachers and school administrators say that the discovery approaches to teaching only work with the better students. I didn't believe them in principle because I know of a counter example or two. However, now I have my own experience with the much greater difficulty of making self-directed inquiry work with average than with exceptionally bright students. A graduate course I've taught for ten years and which lends support in its content to discovery methods couldn't be taught successfully by discovery methods until last spring when my class took over and taught the course themselves, for the most part. It was very clear to me that I had an unusually superior class last year, and that made all the difference.

Putting it in a nutshell, most teachers seemed to treat subject matter knowledge as evidence of, and subject materials as a means to, the socialization of the individual in school. On the other hand, most subject matter specialists treated socialization as a necessary evil, to be gotten out of the way early--for it is only a means to the greater end of subject matter knowledge. Socialized discipline was the lingua franca or "medium of exchange," within the school, transcending subject matter barriers. There was also a socialization within each discipline but only for the talented, college-bound students.

Each teacher had a somewhat different set of purposes, but a most common and vigorously defended purpose was that of socialization. It was intimately related to observance of the mores of the community, submitting personal inclinations to the needs of the community, conforming to the role of "good student," and getting ready for the next rung on the educational ladder. Of course there were great differences among teachers as to how they stress and interpret socialization.

It would be most incorrect to sort teachers into two groups, one which teaches good courses in science and one which indoctrinates youngsters in the social customs and values of the community. In the schools we observed weak and strong teachers alike devoted much energy and concern to socialization.

Both authoritarian and humanistic teachers did so. Of course they worked at it to different degrees, they stressed different values, and used different tactics to effect their aims. Only the disillusioned and the completely intimidated failed to participate in the indoctrination process. Almost no one who cared about education thought that teachers should emphasize social values less, though they had very different ideas about which values should be honored.

It appeared to us that teachers had been carefully selected to fit the community and that teachers were anxious not to put children or parents in anguish--so some occasionally went as "far out" as the community, the parents and the youngsters would let them, but seldom further. Of course there was not full agreement on the "boundaries," but we looked for and did not find confrontation. Observable differences among teachers were much more likely to be in areas about which the public was not apprehensive. Perhaps if all teachers were to take the same stand on some issue as the most radical or outspoken teacher there would have been trouble, but the community seemed comfortable with its mix of relatively stern socializers and relatively liberal socializers.

The more stern socializers promoted subordination, discipline, a "protestant work ethic," cheerfulness, competitiveness, and heavy investment in getting students "prepared." The more liberal socializers, no less concerned about having an impact on the learning and personality of the youngster, promoted skepticism, imagination, individual expression, cheerfulness and cooperation. Of course, most teachers appeared to be trying to do some of both.

An important socialization lesson with most teachers was "merit deserves special privilege." There is little belief at the present time that there could be anything wrong with academic discrimination. In RIVER ACRES, URBANVILLE and elsewhere, denial of learning opportunity is seen as warranted by poor performance. In ALTE, WESTERN CITY and elsewhere, "social promotion" is under attack. Although in this century the high school diploma has not been a certificate of competence, there is strong advocacy for making it one. The denial of privilege that would accompany the denial of a diploma is not at the present time considered a large social cost.

Such socialization in the classroom was pre-emptive in that it seemed to get immediate attention almost whenever an opportunity arose. Other learnings were interrupted or set aside, not always by choice, to take care of: an effort to cheat, an impending daydream, or a willingness to accept a grossly mistaken answer. One OHIO observer commented that socialization takes precedence over general study skills, general study skills over the specific operations (arithmetic, the chemistry lab), and the specific operations over subject matter. One teacher, or perhaps a thousand, said with a sigh, "I don't know what they're going to do when they get to seventh grade."

We found the essence of the dilemma in Mary Lee Smith's final paragraph (p 2:23):

> Teachers must juggle the expectations of the invisible, distant, and mostly impersonal profession of science education and the local, powerful, and relentless demands of teaching. The two roles do not necessarily conflict; but the latter usually overpowers and preempts the former.

Although based on relatively few, but sustained and careful observations, the picture of the teacher in the classroom that we have sketched in this section should be of value to those attempting to support and improve teaching. We can say little about how general are the concerns we have portrayed here. We have received indications from over half of the dozen or more teachers who have read this or heard it presented orally that they recognized and acknowledged an aspect of their professional experience that had not been considered previously. To us, the importance of this picture is that it provides a plausible explanation of why so many teachers reacted negatively to curriculum and pedagogical innovations that once seemed so promising. We were able to ask a number of questions in our national survey that bear on this matter of socialization and we turn now to a consideration of the response we received.

IN A SOCIAL SYSTEM

In the preceeding pages we have said things that might persuade the reader that we have little respect for the teacher. We think our respect for the teacher is considerable. In speaking of the teacher as one who tenaciously pursues his or her convictions, we are describing what we have seen, not speaking in praise or disrespect. As we behold the various and sometimes unrealistic expectations of the public we speak in sympathy and not in hope of helping out.

We have been trying to discover and describe the way science teachers see their jobs. We have been concerned about the inability of the education community to mobilize its forces to provide better education. Many who speak passionately about educational reform of all kinds have been quick to find the teacher and school administrator obstructionists. We found that a poor description. Their efforts contributed little to the aims of any reformist group because they did not agree with the new goals, just as they do not agree among themselves about many goals. They have not primarily been obstructionist. They have primarily been busily engaged in the conduct of education in ways consistent with their own personal values and with values they believe to be widely held in their communities.

The following letter* from a teacher to a local newspaper summed up, we believe, the plight, the optimism, the self-righteousness, and the sense of social service of a great many teachers.

> *Dear Editor,*
>
> *At last, I have had it with articles on what is wrong with education.*
>
> *First of all, after many years as an elementary teacher, I do not feel qualified to make sweeping generalizations about "education in America." It's a little like the blind man and the elephant--it depends on where you take hold. I doubt that any one person is qualified to make the sweeping statements I read in your Sunday edition.*
>
> *I had the best training possible for teaching, with more advanced work than many of us get. I had the advantage of good supervisors, administrators, school board and school systems. As with many of us, I listened to all the "facts," innovators, etc. and then*

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*"Mailbag," The Courier, Champaign-Urbana, Ill., September 1977.

went my own way in trying to teach the best I could. I think this is what most teachers do, so please, no more general statements about "how schools teach."

It is true that there is always someone with a new idea about how it ought to be done. Do you criticize medical people when they get ideas for improvements?

I doubt that the so called tests showing lower achievement are all that well-documented or accurate. The tests were made years ago in many cases, and the ones I've seen lately haven't been updated enough to test what is taught. For example, we have books on modern math but the tests we give are over traditional math, so I teach both. Besides, tests are only part of the picture, and "facts" can be twisted to mislead or to prove almost anything.

I've been around quite a few years--and I've yet to meet this well educated adult population of the past that the articles always compare us to. As Will Rogers said, "schools aren't what they used to be and probably never were."

As Americans, we are too prone to want to throw away the careful work of years, by a few cutting words. Government is a favorite thing to complain about. Education usually gets complaints when times are better and is neglected when they are poorer. I'm not about to sit by any longer while someone cuts swatches through my lifework with a few pat phrases!

Perhaps people get the education for their children that they deserve for them--just as we get the kind of government we deserve. Education certainly reflects society. Above all, the schools are what the people make them.

Sometimes, I do think that courts and high officials are trying to destroy education. They certainly put enough stumbling blocks in the path. The officials and legislators here in Illinois are very quick to take a hand in making rules for and demands on schools. These have to be complied with, whether they are educationally sound or not.

I don't think anything is that wrong with education. For an ungainly moster, it is in pretty good shape. There are lots of earnest teachers, caring parents, and concerned officials.

If there is any "difference" in educational achievement --and I really doubt it--I think it must be laid to the society leading the monster. Remember, the schools are pulled as many different ways as there are differences of opinion in the group being served!

> *If I see any real difference between now and then, it is in the motivation of students. Those immigrants had to learn assuming that they really did. Many youngsters today can probably get by in their culture without putting out much effort--for the time being, at least.*
>
> *--And don't tell me it's as easy to teach a large group as a small one. I've been at it too long not to know the difference.*
>
> *--And don't tell me it's as easy to teach a child who rides the bus a half hour each way, who can't go home for lunch, who has babysitters and little time at home with the family, and who has a family too busy trying to make a living in this inflated world to really give him all the time he needs.*
>
> *Our country does try to educate every child--and most of them seem to want to go to college now.*
>
> *I'm sorry to say that when I find a child who doesn't learn well, if it isn't from lack of trying, it seems to be from lack of what we call ability. Try telling that to a parent!*
>
> *If you think education isn't doing a tremendous job, imagine the country without it!*

Working Within the System. The great majority of teachers we were in contact with were personally committed to the task of helping young people accommodate to the educational system as it is, for their own benefit, and for the teacher's benefit--for the recognition that comes from being a cooperative member of the faculty and of society. Few could see how learning could occur without order and discipline. As indicated in the previous section few saw anything wrong with using the subject matter itself to create order and discipline. Student inquiry and independence of thought were often seen as things one wishes for, but which teachers should not allow to happen without pupils knuckling down to the dull, intricate lessons, first earning the right to express an opinion. Mr. Rogers, a high school biology and physiology teacher in PINE CITY (p 6:33) was noted by the students as a teacher "who makes you work hard," and described by a parent as a disciplinarian. He used spelling tests to stress technical terms and oral quizzes to focus on subject matter.

Teachers guarded against what they saw as the dangers of easy learning, chiefly the danger of exposure to teachers and university professors demanding memorization before understanding. Teachers were society-oriented more than subject-matter or student oriented. They did not want their students to be rebellious. Independence of thought--if acceptable at all--was the student's own business; it was not the school's business. In BRT we heard this lament (p 4:43):

> *You know I kind of get the feeling that this tune of anti-establishment is still with us, though maybe not so much as a few years ago. Students just aren't too*

> *sure that we oldsters have much to contibute to them, that we don't understand them . . . Another thing is I think they're less competitive scholastically than they were even three or four years ago. Students don't seem to mind if they're not on the honor roll. And I don't know how much parents mind either. There's the idea, "Why should I go to college, spend all that money and time, and maybe not find a job?" Gee whiz, there's a lot of teachers out here without jobs. A year or so ago there were all those engineers laid off. They're selling hamburgers or something. Students say they can go out and lay bricks for eight or nine dollars an hour, so why should I go to school.*

This social studies teacher felt that a teacher's chief responsibility was to prepare the child to take another step into full acculturation but explained some of the social problems of the rural community (p 4:42):

> *Our students have to think in terms of a world a little larger than this community, so far as problems are concerned. We had this film the other day in sociology, Black and White Uptight. A good film on the race issue. The class didn't want to discuss it. I could see them shrinking, "Oh no, not that again." . . . I can understand the opinions they've gotten at home. They're simply repeating things they've heard.*

One teacher in RIVER ACRES commented (p 1:53):

> *You have to survive in the community in which you teach. They are paying you your salary with their money, so basically they have the right, to a degree, to keep certain things out of the school that they strongly agree should not be there.*

We took him to be speaking for a broader range of issues than the touchy subjects he has just discussed.

As in the following vignette on teacher overload, some teachers saw the system as rapidly restructuring the business of teaching.

> Carmen is one of the few Puerto Rican students taking the "college-bound" classes. She has at least a ninety average and is in her junior year. Her high school is in a low socio-economic neighborhood. She considers herself lucky to be mostly in classes with high-achieving, working-class, white and oriental kids.
>
> Most of Carmen's Puerto Rican peers are "always cutting out and getting into trouble." Carmen wants to go to college and to be a teacher. She feels that the failure on the part of many students is the fault of both the school and the students.

> *They are bored learning the same stuff over and over again and feel stupid never remembering it. Also, the school doesn't care if the students cut out--less trouble, especially with the budget cuts and everything.*

Carmen is on her way to the junior high to meet and check up on her brother Reynaldo. He gets out of school twenty minutes later than Carmen does. Their parents have expressed concern that Reynaldo does not take schoolwork home and they want Carmen to see what is happening. Reynaldo is dismissed and meets Carmen.

At the same time leaving his class is Mr. Goldhammer, Carmen's former science teacher at the junior high. He approaches and greets Carmen with a big smile. "What's one of my best students doing around here?"

> *I'm here to check up on my brother Reynaldo. My parents never see him do homework. How is school this year?*

> *Things are awful! So many teachers are out of license or being recertified in areas they have never taught. In fact, half of the math teachers in this school are really social studies teachers and art teachers who got laid off with four, five, and six years of experience. Everyone is really down. Even I am. I have to work much harder to teach so many more kids. There are forty or forty-five students in a class. Recertified teachers are just not experienced enough in their subject areas to do a good job under these circumstances. How do you feel about that, Reynaldo? Am I correct in what I am saying? How does it look to you?*

Reynaldo says shyly:

> *You see, Carmen. It's not my fault. My teachers skip around a lot. It doesn't make sense to me. Mrs. Weinstein can't control our math class. She gives us a test every ten minutes or so when the class is not listening. I do okay by my test because I had the work last year, but most of the kids don't know how to do the work and don't take the test. Hell! Not only am I not getting homework but I'm not learning. She can't teach anyway, especially because she can't control the class.*

Mr. Goldhammer says:

> *Things may be better in high school. At least high schools are controlled by the central board. No local community school board, probably less juggling of teachers. How is it at your school, Carmen.*

Carmen responds by saying that the teacher of her chemistry class is really an industrial arts teacher but other than that all her teachers are in license. And

> *The largest classes are those with the smartest students and those students are working harder than ever before. They are trying to get as much education as they can from the overcrowded conditions. There are more oversized classes for the smart students because teachers who want the good classes are willing to accept more students in their class. The enriched intermediate algebra class that I am in has fifty students while the regular intermediate algebra class has only thirty-eight. It sounds crazy but sometimes I think that the budget cuts make students care more about school and care more about learning.*

A colleague of Mr. Goldhammer's, Mr. Clancy comes out of the school. Mr. Clancy and Mr. Goldhammer are in the same car pool. Mr. Goldhammer says:

> *Well, Carmen, it has been a pleasure to see you. I'm glad to hear you are still doing great. I hope to see you again. I'll try to speak to Reynaldo's teachers.*

Mr. Goldhammer and Mr. Clancy start off toward the car, stepping around a bunch of boys gambling outside a tenement house.

Mr. Clancy says:

> *You know, I'm starting to think that the back to the basics movement is just a way of rationalizing the budget cuts. Still I hear that at the high school the remedial classes, general math and math lab, are surprisingly calm. It might be due to the required minimum competency tests. This might by why the high school teachers seem to like the back to the basics movement.*
>
> *Did you hear that the union might lose its dues checkoff privilege because of the Taylor Law violation last year? The union is going to be in big trouble trying to get membership to send in their dues on their own. Hell, the union sold us out anyway.*
>
> *Come on, George, don't take everything so seriously. It's not worth it. Let's beat the traffic.*

Headed home with Carmen, Reynaldo says, "I told you it's not my fault."

> *Well, I don't think you want to be a drop-out like so many of the kids. Do you like not getting homework, Reynaldo?*
>
> *If I got homework I would do it.*
>
> *It's too bad our mama and papa don't ever visit your school. They should complain about your teachers. I'll teach you math when I have the time so you won't go on to high school and only attend two days a week like so many kids who just have folders to work in. They don't ever carry books, pens, or pencils. They just get stoned all the time or gamble or both.*

> As Carmen and Reynaldo go into their apartment building in the projects, a group of teenagers are drinking wine. They call Carmen "jaitona" (snotty) and other names. Carmen hurries into the house and begins to prepare dinner for the family.

In contexts such as this questions of optimum pedagogy and choice of subject matter are over-ridden by making do, minimizing the losses, struggling to survive. The social system and educational system both seem the enemy, preventing the teacher from conducting even the minimum affairs of coursework. Still the teacher mobilized a daily effort to bring youngsters along to a maturity, to a socialization, that that teacher admires.

Anthropologists tell us that teachers in all societies pass on the values of the society. This we found in all our sites. Schools were the creatures of the social system more than of the Academy. Curriculum questions many places were lower order questions. But respect for science was still a part of the system. Regarding public opinion of science we heard in FALL RIVER (p 2:9):

> *Now the public is questioning the value of science, for some good reasons. Sometimes it has appeared that science has been misused. People are upset with the high costs of science, particularly the space program. What they don't realize is that this enjoyable society has been brought about by basic research . . . I spend a lot of time in class explaining the benefit of doing basic science.*

Another FALL RIVER teacher questioned the value of an extensive science education for all students. Despite this though, he still adhered to the belief in the importance of science knowledge:

> *. . . this is important for all ability ranges of students, a sense of being at home in the universe must be transmitted. The physical world and the technology of man must be dealt with as an important part of the total culture he is to inherit.*

Working Alone. We found the teacher working alone. During most of the day the classroom was filled with youngsters. Many helped the teacher, often the talk was person-to-person. Sometimes an aide was there, or a parent, or a cadet teacher. Other teachers influenced what the teacher did, but the teacher worked very much alone. Even those few teachers who were "team teaching" were trading-off rather than sharing teaching responsibility. The teacher was little dependent on any other adult, and the dependence of other professional educators on her or him was more rhetorical than apparent. It would be unrealistic to say that the teachers we saw were subordinate to a head of a department or administrator or part of an instructional team. They worked alone.

The job was as intellectual as the teacher wanted to make it. There were always opportunities to explore a new connection, to probe a strange way of thinking a child had got into. There was an abundance of literature on education, on science, on social science, on mathematics in almost all the schools. Some teachers were into it all the time, others were not--just like other people. Teachers told us they read quite a bit of this literature (see page 18:24), seeing it more as the pursuit of their intellectual curiosity rather than the effort to attain a higher professional competence.

We asked around about an archetypical "Mr. Science." We found one in an outlying suburban community in Southern California. We thought of him as the ideal the schools promote, as what every science teacher should strive to be.

A "Mr. Science" Vignette.

> Sometimes when we think about a "Mr. Science type" of teacher we think of someone like T.V.'s Mr. Rogers, or Galloping Gourmet, or Jacob Bronowsky, one who commands attention by his personality and seeming flawlessness in handling the subject matter. Mr. Armison wasn't that; at least the klieg lights in his classroom were on what the students were doing, not on what he was doing. About 25 juniors and seniors in his anatomy class, Mr. Armison behind them, all facing a chalkboard, scribbled with the language of the muscles.
>
> *T: Let's start with deep peroneal nerves. (Another team of 4 students, 4 husky boys, go to the front tables, facing class.)*
>
> *T: Okay the problem is deep peroneal nerves. The deep peroneal nerve has been cut; there's function on one leg. What loss of muscular function is expected? Can this person come into your class or office? How would you expect the deformity or problem to be exhibited?*
>
> *S#1: OK. He would lose 100% of his dorsal flexion and about 80-90% of his (inversion), so as he came in there he wouldn't be able to raise his toe. When he walked he'd come and he'd walk like this. (demonstrates down aisle) He wouldn't be able to raise his toe, so he'd just drag it along. It might also go out a little bit.*

16:28

T: What remaining muscles innervated by other nerves can be trained to do some of the lost function?

S#2: (using notes) Well first of all the muscles that are going to be lost when you lose the deep peroneal nerve are the tibialus anterior, the extensor digitorum longus, the peroneus tertius, the extensor hallucis longus, and extensor dogitorum brevis. To make up for those muscles which were lost the tibialis posterior would take over and the flexor hallucis longus and the flexor digitorum longus and they would be generated by the posterior tibial . . .

T: Take over in what respect?

S#2: They would bring back the dorsal flexion and the loss of inversion. They would compensate for what is gone but they would bring back, y'know, only 10-15% of it.

T: of the dorsal flexion?

S#2: of the inversion

T: Oh, ok.

How about dorsal flexion? Any of those that could be trained?

S#2: No.

T: Good. Three: Describe therapy exercises in anatomical and in layman terms to strengthen the remaining muscles.

S#3: Ok. There's so much lost that there's nothing you can do for dorsal flexion. As for inversion------

The rest of the class paid attention, laughing at primitive efforts to draw a foot, some hoping that their turn would be put off a day.

How could any bunch of with-it California youngsters be turned on by muscles of the human foot? According to Armison, what the students do in science depends mostly on what you expect them to do. He allowed that this was not an unusual class though the course is an elective, most of the kids are pretty bright, and most are thinking a lot about nurses training, football injuries, artistic drawing, or something that relates such antiseptic systems to themselves.

Armison expects them to produce: to recognize a bone from any angle, to answer naming questions without a seconds delay, to write research reports from personally gathered data and with reference to professional journals and other reports of recent scientific studies. He does not expect them to be perfect. He expects hard work, verbal quickness, and reflection. He has a reputation—most students know what they're getting into. And afterwards, at least, they too pass the word that it was a good course. His key: never consider that less from them would be acceptable.

Little homework is assigned. Still they carry their cat home to work on dissections. Each one spends some time with human dissection as well. Armison stands as a table of expectations, a resource, a traffic light. The students do the learning and much of the teaching. Aids from last year's class demonstrate, take charge of the whole class in special moments. They arrange the specimens for make-up tests, and administer them. Nobody challenges their authority. Nobody questions their crossing of boundaries between teaching and learning. Students are expected to help each other.

It might be expected that some teachers would resent the flouting of convention, or at least that their work load might pale in comparison to his. It wasn't apparent. A teacher sometimes remarks "It looks like something is happening in Anatomy class because the students are all talking 'bones'." Perhaps there is a resentment that the high expectations and standards of one teacher robs study time from other classes. For a different reason, Math teachers earn such resentment. It did not seem to be a problem at Point Loma.

Of course not all Armison classes are volcanic. A recent class in marine biology seemed to have all the motivation of the jelly fish they collected on field trips. In class at least they drifted with the current, occasionally testing his authority. The formula didn't always work.

Armison worked pretty independently. No one else taught these same classes, though a couple of teachers kept track of his assignments in case they would have to, or get to, teach such a course some time.

Getting his space fixed up was a problem. He originally was given $600 to start the course. He browsed in shops selling used medical supplies, bought a bunch of junk. By a great stroke of luck, an opportunity came along to have all the lab equipment replaced or repaired—and his junk turned into a working anatomy lab. He needed journals, so he advertised in a Shoppers Guide, and got donations "by the wagonload" from retired professional people.

He took pride in being a scavenger, derided the idea of packaged science courses. Armison felt that the experience in a science course has to touch the immediate concerns of teacher and student at least once every day, that the assignments have to be guided so that there is personal meaning to the study of the basic knowledge of the course. He has found few education courses useful, has never attended a workshop. He wants science teachers to have their own professional societies, to meet occasionally and to talk about new developments in the field.

Selecting new teachers is perhaps the key decision a school makes—and he felt that present teachers should play a major role. His Superintendent was taking action that increased the number of first year teachers. Armison thought that was a mistake, that it was too risky to take persons with no experience when experienced persons were in large supply.

Armison had little hope for any assistance from the district, state, or federal level. The California program for Mentally-Gifted-Minors got him funds to purchase some much appreciated skulls and models, but he felt the program itself raised the wrong expectations in the minds of too many students, parents and teachers. If any students are to get special attention from society because they are likely to contribute so much in return, he felt it should be to the high achievers—a different group than the MGM group.

He was not greatly distressed by the Stull Act or at efforts at Agencies to specify the objectives for a course. Somehow the teachers he knew remained suitably insulated from the political turmoil. The course objectives were obvious and needed little attention, once you had first "put them together" at least in physiology and anatomy courses. He found no contradiction with the need for teachers to change their courses each year (to keep up with the times) and to stick to a set of objectives (always oriented to student ability to know the parts of the body and their complex interdependencies).

Asked what NSF could do to help improve science education, Armison mentioned two types of support: regional symposia for teachers, and grants to individual teachers for the development of curricula for their classrooms. The symposia might be offered separately to teachers in different specialty areas, e.g., chemistry, biology, physiology. Teachers are most likely to be able to attend if given released time for doing so. The symposia should feature recent developments in the field; education classes had been of relatively little value to Armison. He strongly favored the individual grant approach to curriculum development to the dissemination of materials developed either by researchers or by teachers.

> *I don't like, nor do I very often use, materials prepared in total units by somebody someplace else. Every course is what one teacher has to make it. It has his personality, his stamp on it. No one else could teach this (anatomy) course. . . . Science rooms are filled with some other teacher's dreams of what a class should be. It just stockpiles back in a corner someplace.*

Mr. Armison was a fine teacher, a challenging teacher, though not really specializing in "inquiry teaching". He was similar to the teachers Frances Stevens told of earlier in the chapter, stimulating, personable, bright--but thoroughly determining what the youngsters were to learn, teaching them the official parts and authorized parts and purviews, not drawing from them the personal creation of ideas. Should he have been more? No one suggested that to the observer. Not many teachers or parents told us anywhere that the child should be given every help to be an independent thinker.

We observed little inquiry teaching in the eleven sites. Most of that was in elementary and junior high schools. We asked junior high school principals and elementary teachers in our National Survey samples to respond to the following questions: (The responses are given below each question; "†" indicates differences of special interest.)

> Please estimate the percentage of instruction time the average teacher in your school spends in "inquiry teaching," that is, lessons in which students design and carry out their own investigation.

	47 of 86		78 of 150		
	7-9 Principals		K-6 Teachers		
	N	%	N	%	
†	16	18%	34	40%	Less than 10%
†	19	55%	12	14%	10% - 25%
	7	10%	10	11%	25% - 50%
	2	1%	5	12%	More than 50%
	3	16%	17	23%	I don't know

We estimated the median here to be about 10% time spent in inquiry teaching, still a bit higher than our field observers reported.

Why isn't more time spent in "inquiry teaching" (as defined above)? (Where more than one response was given, one was randomly chosen and included below. See also p. 18:68).

46	7-9 Principals		76 K-6 Teachers	
	N		N	
	5	†	9	It is too hard to ask students enough of the right questions
	4		12	Students are too likely to "goof off."
	11		22	The necessary equipment and supplies are too difficult to provide.
	11		22	Most students cannot really carry out inquiries effectively.
	0	†	0	Inquiry gives pupils the false impression about what learning is.
	15		11	Other

We noted that the emphasis we have given to socialization in this chapter was not supported by the zero response to the last alternative above. Here and elsewhere teachers sometimes denied that they were promoting a certain set of habits and attitudes, more of a cultural than intellectual kind. We expected that at least a few of the teachers would have objected to inquiry teaching (as some of our interviewees did) because it gave the impression that science is not a serious, highly purposive activity.

Case study observers found few natural inquirers among teaching staffs. PINE CITY's Miss Green (pp 6:18 to 6:24) was such a teacher. (Read particularly Rob Walker's discussion of Miss Green's personal sensitivity.) Rob quoted her as follows (p 6:24):

> *I'm striving to motivate my students to find something that they will be interested in. When I see them full of questions--really interested--then I find ways or sources from some place. To me the most stimulating experience is feedback from the students.*

At BRT, Mrs. N. (pp 4:7 through 4:18) was a teacher highly interested in scientific matters as well as students and community. She preferred, she said, "Labs where you don't tell the kids what the answer is," and continued (p 4:10):

> *I let them think about it and ask them questions and then respond to their questions. I think that's better because that's what the lab is supposed to do--give them an idea of how general concepts were first determined. If they already know what the outcome is going to be, they don't see the significance of doing the lab. In the classroom this kind of teaching is harder to do. I'm not good at it. I have difficulty asking the right kinds of questions. I can ask questions if I have something physical to look at. Just like today in physics class--I had trouble asking the right questions to get those kids to see what I wanted them to see in that problem about the car on the ramp, that the weight would act straight down.*

Her self-analysis was confirmed by the transcripts of portions of several of her classroom discussions (pp 4:11 through 4:18) and in the description by site visitor Charles Weller of one of her biology labs. He wrote:

> The students were working in groups of 2 or 3, busily involved in the activities, in what looked like a very good laboratory. The teacher was walking around and talking with the groups in a relaxed manner. The students were getting things done and enjoying it.

In ARCHIPOLIS, an elementary school teacher said (p 9:4):

> *Actually, I really enjoy science. But I haven't had the time, with all the other things to teach, to put time into developing a science activity. Actually, the children enjoy it. We sent the children to the environmental lab, and they came back bubbling. EPA puts it on. But with the press of other things I just couldn't take up on that.*

We found another example of a teacher who thought that laboratory work should be interesting, not just finding out what's obvious, in the BOSTON case study.

As reported in "Conversations in the Teachers' Lounge," Steve was listening to David's argument that method had to be taught before dramatic experiments can be worked on. David summed it up:

> *And for most of them, writing a scientific report is not something they are used to doing, in fact some of them have got so used to multiple choice tests that it is an effort for them to write complete sentences.*

Then Steve replied (p 11:6):

> *Maybe you are right. I think teaching them rigor and method is a useful thing to do. The danger though is that you end up just pacifying them. The science that is going to affect their lives isn't the five stages of writing a lab report. It is nuclear power, pollution, recombinant DNA research. Those are the things I want them to know about, and I want them to be able to pursue things for themselves, not just because they are in a course or a textbook.*

Here was the exception of two teachers working closely together. And both of them pointed to one of the teachers' major dilemmas. If they wanted the work done according to standards set in university level courses, or even in the best secondary school traditions, they had to "spoon feed" a lot of students, leading them through the steps by hand, and probably ending up with unhappy students, needing to be "pacified" one way or another.

We were particularly interested in the utility teachers saw in probing pupil responses to tease out the logic of their incorrect responses. We asked our sample of mathematics teachers in secondary schools and our sample of elementary school mathematics curriculum coordinators to respond to the following scenario:

Scenario V

Please consider this dialogue as a teacher visits a math consultant:

Teacher: I gave 2 + .3 = ? to Tom. He rewrote it on his paper like this: and wrote down the answer, .5 and said, "point five."

$$\begin{array}{r} 2 \\ +.3 \\ \hline \end{array}$$

Tom works hard. I believe he likes the individualized math program that we have here in the sixth grade. He has had those problems lots of times. He may not get them right the first time, but he corrects them and is done before the other kids!

I drew three rectangles and asked him to show me what 2 + .3 would be, "using rectangles." He divided one into ten parts, shaded 3 of the parts, then shaded the other two rectangles and said, "The total is two and three tenths."

I pointed back to the .5 and said, "This answer is different. Which is correct?" He said, "Both are correct." I said, "But we started out both times with the same question. How could both answers be correct?" He said, "It depends on the key."

And I guess Tom taught me something when he said, "I'll show you. If I have the problem 2 + .3 = ? and I put down 2-3/10 for my answer, I get it marked wrong. If I have this one (pointing to the rectangles) and I put down .5 I get it wrong. So to get it right, I have to figure out what the key wants."

Mathematics Consultant: This is not uncommon in these individualized programs but I never heard it expressed with such conviction.

I doubt if you can change his view of the "arbitrariness of scoring-keys" overnight. Lots of kids think math is just a bunch of disconnected rules. Emphasizing "place value," that you can't put 2 and .3 in the same column, seems unrelated to the idea of 3 parts out of 10, 3/10.

What I would look for is the "analog" he has, the incorrect rule that does allow him to put 2 and .3 in the same column. What is his logic? If you find that, you may be able to persuade him that the answer ".5" will always be wrong to this question.

Teacher: Are there some materials I could use to help with this problem?

Mathematics Consultant: I know of some you could try, but you will have to have time to study them carefully yourself. Students see the different formats and conclude that "each is a different kind of arithmetic."

Scenario V

It was interesting to compare their responses. They suggested in Questions 1, 6 and 7 (especially where marked †) that elementary supervisors saw a condition that secondary school math teachers were less aware of. In our review of the data we noted that teachers were more involved in the designation of able students for awards and admissions and supervisors often had greater opportunity to study the epistemological problems. Question 1 was:

> Have you found bright students in mathematics classes who are somehow unable to discriminate between significant and insignificant details, bright students who fail to get the "big picture?"

Their responses were:

	K-6 Math Supvsrs.		7-9 Math Teachers		
	N	%*	N	%*	
†	61	50%	32	34%	It is rather common
	48	50%	42	55%	There are a few cases
	3	1%	7	11%	Do not know of any such cases
	112		81		Number responding

On open ended Question 2: If you were Tom's teacher, how would you deal with this problem of his? The initial categories set up for coding responses were:

	K-6 Math Supvsrs.	7-9 Math Tchrs.
	N	N
Try to understand his "logic" then modify teaching method or materials.	5	1
Reteach place values.	8	9
More drill work.	1	3
Ease up/get someone else to tutor	0	0
Other	68	56
(No comment)	34	12

With additional categories of response created a posteriori, we found the results listed on the next page. Overall there was little difference in the patterns of response. However, the codes gave the impression that the supervisors used more sophisticated language to describe and prescribe what to do.

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*All percentages given in this chapter were weighted according to the RTI sampling plan. See Chapter 18.

Table 16-2: Response Categories to the Question,
"How would you deal with Tom's problem?"

7-9 Math Tchr		K-6 Math Supr	
1		7	A. Manipulable objects and representations of familiar objects
2		7	1. Tangible, "concrete" manipulable objects (e.g., Dienes' blocks)
4		9	2. Drawing, "semi-concrete" representations (e.g., rectangles, pies)
6		6	3. Imagining practical, real-life situations (e.g., money)
13	<	29	
1		7	B. "Abstract" manipulation of symbols, rules, techniques, notation
30	>	18	1. Vertical columns with place value labels, decimal points, etc.
1		1	2. Common fractions, mixed numbers, equivalent fractions
0		2	3. Horizontal, equation-style notation
0		2	4. Integers
32	>	30	
1		1	C. Equivalences
15		7	1. Between different numerals, expanded notation (e.g., 4 = 4.0)
12	>	12	2. Between common and decimal fractions
1		2	3. Between "concrete," "semi-concrete," and "abstract" quantities
2		2	4. Between integers and common fractions
1		0	5. Between fractions and division
32	>	24	
0		1	D. Mathematical ideas
3		2	1. Part-whole relations
4		4	2. Wrong procedures, wrong answers (one answer for each problem)
0		2	3. Inequalities
0		2	4. Value of procedures, concepts, symbols, etc.
6		5	5. Independence of key - rationality
2		2	6. Adding like quantities only
1		0	7. Analogy with other bases than ten
1		0	8. Rules are like laws, necessary for harmony and communication
1		0	9. What problems state or imply is important
18	>	18	
0		0	E. Teacher activities
32	>	22	1. Explaining, telling, showing how, reviewing, emphasizing for Tom
8	<	16	2. Questioning, exploring, diagnosing, testing, listening to Tom
1		5	3. Feeling challenged, angered by Tom, is he phony?
0		5	4. Encouraging and guiding Tom
12	>	12	5. Assigning, specifying, drilling, supervising
0		3	6. Analyzing own teaching
7		7	7. Analyzing key & marking system
2		0	8. Informing pupil of progress
62	>	70	
0		0	F. Tom's activities
0		2	1. Discussing with teacher, other pupils
3		6	2. Discovering, calculating mentally, reflecting, experimenting
0		3	3. Explaining, drawing, showing, etc.
1		1	4. Exploring, questioning, challenging keys
2		4	5. Evaluating own work
6	<	16	
0		0	G. Arrangements
3	<	11	1. One-on-one, Tom and teacher
1		4	2. Small group, informal peer discussion
1		1	3. Large group, formal
1		2	4. Persistence over time
1		0	5. Non-individualized
7	<	18	
12	<	34	NO ANSWER GIVEN TO THIS QUESTION
170		205	Total entries in response categories
81		116	Number of respondents returning questionnaire
3	:	4	Approximate ratio of groups

Scenario V continued

We have placed an inequality sign between the numbers of entries in a given category where the numbers are large enough to suggest some possible trend. However, we have not computed %s or standard errors since there were an average of about two entries in responses categories for each respondent. The inequalities are consistent with two possible hypotheses: (1) that K-6 math supervisors who had an enormously varied list of actual titles) were better trained in mathematics pedagogical theory than 7-9 mathematics teachers and (2) that K-6 math supervisors are more experienced in the informal methods acceptable in many elementary schools than 7-9 mathematics teachers.

Possibly more interesting than the distribution of these very heterogeneous responses are the explicit formulations two junior high school math teachers gave to the moral uses of mathematics. One wrote in response to the question.

> I would not have gone to the rectangle method. I would have discussed place value instead. Also, I emphasize that rules like laws must be followed if society is to progress and communicate.

The other wrote a lengthy reply which included these remarks, making a religious metaphor of conversion to the confession of error.

> *I find that on the high school level, a student with such a background is impossible to teach until he can admit that maybe he may have been using erroneous logic. That's very difficult to elicit from the student. In our school, I teach all low-proficiency students. . . . Once I can get them not to be ashamed of deficiencies in addition facts, for example, progress can be made doing something about these deficiencies. Sometimes this takes a year for some students, if this conversion takes place in a group, the results are even more fantastic. Then we are in this learning process together with group support.*

Question 6 was:

> As you look at mathematics courses in your school and elsewhere, you probably see things that concern you. Please check those things below that you consider to be major problems. (Check any number)

112 of 198 K-6 Math Supvsrs.	81 of 150 7-9 Math Teachers	
N	N	
+ 67	69	- students have been promoted without knowing basic mathematics
+ 40	14	- too little emphasis given to the "big ideas" of mathematics
+ 63	32	- too little attention to the "logic" students use to get wrong answers
+ 39	49	- the curriculum under-emphasizes the basic skills
19	15	- the public and administrators are pushing for the wrong things
48	32	- too little attention is given the individual student as a person
62	25	- too little help is available to the teacher with teaching problems
23	26	- class periods are too short, classes too large
+ 16	31	- textbooks or workbooks for basic math inadequate for older students

Scenario V continued

Question 7

Most seventh grade teachers are disappointed with the skills and knowledge children have when they arrive in September, finding them not ready for seventh grade lessons, needing relearning or even new learnings to get ready. And so with the sixth grade teacher, and the fifth, and so on down. Is this not so?

	116 K-6 Math Supvsrs		81 7-9 Math Teachers		
	N	%*	N	%*	
This is the way it is.	94	79%	55	69%	†
This is not the way it is.	13	16%	13	9%	

Most teachers assume that it is their responsibility to get children ready for the lessons of subsequent years. Is this not true?

It is true.	88	86%	63	88%
It is not true.	17	9%	7	5%
I don't know.	6	5%	7	7%

But, examining their own lessons, the projects they assign and the learning experiences their pupils are having, many teachers recognize that they have much broader aims than just getting the youngsters ready for next year's learnings. It distresses them to think of diminishing the broader aims in order to spend more time on the particular skills and knowledge the next teacher may require. Is this not so?

That is the way it is.	65	69%	35	43%	†
That is not the way it is.	25	20%	26	31%	
I don't know.	14	9%	17	26%	

How do you feel? Should most math teachers reconsider the lessons, the projects, and the experiences in their own class toward the purpose of getting youngsters better prepared for the lessons of the next year?

Yes, definitely.	42	62%	39	52%	†
No, the broader aims are important too.	50	33%	26	31%	
Other.	10	5%	11	17%	

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*The percents were based on the 116 of the 198 supervisors responding and the 81 of 150 teachers responding. Percents were weighted according to the RTI state by state sampling plan. Standard errors are given in Chapter 18.

The preceding item was one of the most interesting to us. We wanted to confirm the observation that the preparation ethic (as discussed on page 12:16 and in an earlier part of this chapter) was very strong in the American schools and yet that it conflicted with a belief that teachers had that certain social and intellectual experiences (as discussed early in Chapter 15), broader than course prerequisite skills and knowledge, are at least as important. These data supported both those ideas. A conflict exists between the narrow pursuit of the "basics" and the programmatic intent of many teachers. The fact that the teacher is not highly exposed to the public, that many parents share those ideals, and that many of the youngsters learn the basic skills regardless of what the teacher does probably keep it from being a serious conflict.

TEACHER SUPPORT

In The Unseen Revolution, Peter Drucker referred to the power and sweep of current population changes as a "true revolution," likely to rival Communism and the Industrial Revolution in terms of impact on individuals, families, and societies. "So far," he asserted, "only American society has even tackled the issues of this demographic revolution."*

The case studies and assimilation chapters document the effects of this response on public schools; poignant remarks by teachers, parents, administrators, counselors and students added a human dimension to Drucker's rhetoric. Given its traditional reliance on teachers functioning alone in classrooms with groups of children and adolescents representing the vanguard of this change**, how can the school effectively operate?

In this section we reflect upon support systems for the classroom. To date, most of these systems have added to the labor-intensive nature of education. Fiscal constraints and new priorities suggest that this pattern cannot be continued in the future. Two recent statements outline the dilemma. Calling for a "reassessment of conventional wisdom," Jonathan Sher advocated less employment of rural school consolidation, greater use of "regional service centers" and community-based support systems.*** Meanwhile, the economist Hyman Minsky warned that the "Roosevelt reforms" of the 1930s, though valuable in their time, now obstruct the path of a "progressive and humane society." He concluded with words very similar in meaning to passages found on pp 17:23 and 17:24.

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*Peter Drucker. The Unseen Revolution: How Pension Fund Socialism Came to America (New York: Harper & Row, 1976), Chapter 1.

**at a conference on "Communications" we heard the expression: "For teachers McLuhan was a prophet; for students he was an historian".

***Jonathan P. Sher, ed., Education in Rural America: A Reassessment of Conventional Wisdom (Boulder, Colorado: Westview Press, 1977), Chapters 2 and 7.

> *Policy must move beyond maniputation within our institutional structure and forward to another creative era of institutional reform.**

Curriculum Coordination. An URBANVILLE site visitor summarized the attitudes of school people, parents and students toward support for teachers (p 5:23):

> By and large, (they) were pleased with the programs of course work in their schools (but) expressed reservations about support from district offices. . . .

In many systems the school district person most responsible and involved in helping teachers with pedagogical and curricular problems was the curriculum coordinator or supervisor. More than other school district personnel, the curriculum supervisor was expected to have responsibility for maintaining and improving the instructional curriculum. Having passed historically from the teacher to the principal to the superintendent, curriculum coordination was (in many districts) eventually delegated to supervisors--advisors and senior educators who would coordinate efforts. The arrangements varied greatly. What the historian found in 1977 was a diffusion of titles, multiple responsibilities, and varied procedures for sustaining and changing curriculum practices in classrooms. The lack of clearly defined procedures for delivering curriculum and staff development--according to Unruh and Turner--led to so much overlapping of responsibility and unnecessary confusion that the effectiveness of instructional supervision has been impaired.*

Understaffed, advisory in nature and usually lacking in political power, unacquainted with the hostility and disorganization of the more recent confrontations, often untrained for the job and reassigned new obligations as part of frequent district reorganization, and with a tradition of teachers in control of the classroom, supervisors faced an almost impossible task. Supervisors of course were limited in authority either to "install" and nurture district-selected curricula or to help teachers with problems. But some saw it differently. A principal in RIVER ACRES pictured his authority in curriculum planning (p 1:9):

> *You want to know why I'm boss here? I'll tell you why I'm boss here. Because I have authority. You need coordinators (at the district level) with real clout if you want an integrated, funnelling program. You need people with authority, not with "supervisory" capacity. That's the way things get done in Texas. Until that happens each principal will run their own school the way he wants to. When the Associate Superintendent speaks, we do it. The others muddy the waters.*

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*Adolf Unruh and Harold E. Turner, Supervision for Change and Innovation (Boston: Houghton Mifflin, 1970). Some critics are quick to presume that organizations have vague charts with little explication of responsibilities that are ineffective. The current problem with curriculum coordination probably lies elsewhere.

Our case studies did not focus on district programs or responsibilities. Still, hopeful of providing the National Science Foundation with information for planning support programs we took the opportunity in the national survey to find out more about the people who coordinate district curricula.

The range of titles used by K-6 math supervisors* in answer to one of our survey questions impressed us as the tip of the iceberg of organizational patterns for managing the curriculum, and of the amorphous quality of the supervisor's role:

science-math supervisor
math supervisor
math coordinator
math department chairman
teacher of gifted and talented
principal
curriculum consultant
math consultant
math-science consultant
classroom teacher of math 5-6
general elementary supervisor
instructional consultant
assistant director of math K-6
Title I coordinator
elementary education supervisor
math specialist
assistant superintendent for elementary
assistant superintendent for instruction
elementary curriculum coordinator
math resource person
field consultant
coordinator math pilot project

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*The people we called curriculum supervisors or coordinators in our national survey were those people named by the superintendent as in charge or most knowledgeable about the district program. Research Triangle Institute obtained the samples by asking superintendents for the names of curriculum supervisors. Their request went on to say: "If there is no district supervisor for a particular category, please provide the requested information for the district staff member who would best be able to answer questions concerning the district program in each subject area and grade range. This person will usually be a member of the central staff, e.g., the curriculum director, the assistant superintendent for instruction, or the superintendent. It is possible that one person could be designated to provide information for two or more categories; we have designed the questionnaires so that each person will be able to provide all of the required information in less than 30 minutes."

At the secondary level their answers revealed a preponderance of administrative and teaching loads over supervisory tasks. About half the respondents at the elementary level had supervision as a primary assignment:

	K-6 Sci	K-6 Math	7-12 Sci	7-12 Math	7-12 Soc St.
	N	N	N	N	N
Curriculum Supervising	67	59	33	34	50
General Administration	31	25	11	16	17
Teaching	27	20	35	41	28
Department Head	1	1	8	4	10
Other	5	5	50	35	46
	131	110	137	130	151

(Using the weights provided by RTI, the percent of people who had supervising as a primary responsibility in each of the 5 categories, all treated as supervisors, were respectively 37%, 24%, 4%, 13% and 16%. The weights reflected the huge number of small superintendencies in the United States.)

We asked about the percent of their employment they devoted to supervising, coordination or consulting with teachers on instruction:

	K-6 Sci	K-6 Math	7-12 Sci	7-12 Math	7-12 Soc St.
10% or less	22%	26%	56%	30%	32%
11% to 25%	17%	37%	13%	13%	26%
26% to 50%	18%	16%	10%	14%	14%
51% to 75%	19%	11%	4%	12%	7%
76% to 90%	4%	7%	2%	2%	17%
90% or more	20%	3%	5%	28%	4%

A substantial proportion were supervising other curriculum areas besides the area (science) (math) or (social science) for which they were asked to respond in the survey.

Do you supervise curricular matters in areas other than (science) (math) (social science)?

	N	%	N	%	N	%	N	%	N	%
Yes	86	67%	65	79%	47	65%	53	59%	64	55%
No	44	34%	45	21%	86	35%	75	41%	82	45%

We asked: to how many teachers do you provide consultation and aid? The medians were as follows:

K-6 science coordinators	:	300 teachers
K-6 math coordinators	:	477 teachers
7-12 science coordinators	:	219 teachers
7-12 math coordinators	:	251 teachers
7-12 soc st coordinators	:	251 teachers

We had expected such a degree of specialization in the schools that each district would have a person more-or-less in charge of coordinating the curriculum in each of the three areas, social studies, math, and science, and that a substantial portion of that person's workload would be devoted to coordination. We did not presume that that was desirable, just that it would be the case.

What we found in our observations in the sites was that persons in the district office would put out bulletins from time to time on curricular matters, that important planning would be made by committees of teachers and administrators and other resource personnel, and that the teacher seldom was personally in touch with a curriculum coordinator per se. The picture from the survey gave partial confirmation to that, indicating that those most in charge of or knowledgable about the curriculum, as designated by the superintendent, were people who had many and varied responsibilities and could devote only a minor share of their time to coordination, and on the average had in excess of 200 teachers to work with. There were very few people available outside the classroom to provide quality-control for the curriculum and assist teachers with pedagogical problems.

Perhaps one of the reasons why a district would not provide more assistance (suggested in the earlier part of this chapter) was that teachers and supervisors emphasize different purposes and values. Lou Smith reported a dilemma of this sort in ALTE (p 3:25f):

> First and perhaps foremost is the tension or dilemma between the bureaucratic/organizational tendencies and the individual/professional tendencies. On the one hand the organization is continually striving for rationality--agreed upon goals and priorities, clarity of procedures and organizational mechanisms, responsible supervision. That is, there are committees with domains of activity and chairmen responsible for their functioning. On the other hand, . . . there are highly trained, competent professionals in schools and classrooms who are selected, hired, and expected to know what to do in their own domains, to choose and decide intelligently and responsibly, and who exercise and enjoy their autonomy.

Perhaps the more advanced training a supervisor or curriculum coordinator receives the less likely he/she is to be sympathetic with the uses teachers make of math, science or social studies to socialize students into the school's behavior norms and the more likely they are to stress intellectual motivation, interesting materials and devices which teachers fear will make their pupils dependent on them and unwilling to tackle the drudgery they see ahead.

Whether or not teachers want help from curriculum and pedagogical specialists is an interesting question. Not unexpectedly, they wanted more of the good help they had had and less of the bother masquerading as help. A high school science teacher in BRT expressed an unusual point of view (p 4:7):

> *There is one thing I miss about a larger school though. The one I was at before gave a free period to the department chairman and he'd come watch us teach and offer constructive criticism. . . . There's no one in my area who can come and say, "Now this might be a better way to do this."*

Many were dubious that the district, or the college of education, or any other agency would have someone who could help. But still most were willing to try. We did some checking as to what service or help they wanted from a supervisor.

When survey respondents ranked the importance of five responsibilities of the science curriculum supervisors, assistance to teachers with teaching problems ranked highest. In regard to coordinating testing with curriculum development, respondents did not see that the curriculum people are insufficiently governing the testing. Supervising the collection of student performance data ranked low.*

Please rank the importance of responsibilities of a science curriculum supervisor--as you would like it to be. Rank "1" as the most important on down to "5" as the least important.

Importance of responsibilities of a science curriculum supervisor
...as K-6 science supervisors would like it to be:

Median rank	
1.3	Assist teachers with problems they are having with teaching
2.0	Provide information about different teaching methods and materials
3.1	Assure that a high level of subject matter is maintained
4.1	Assist administrators in getting funding for programs
4.3	Supervise the collection of student performance data

...as 10-12 grade principals would like it to be:

1.6	Assist teachers with problems they are having with teaching
2.3	Assure that a high level of subject matter is maintained
2.3	Provide information about different teaching methods and materials
4.3	Supervise the collection of student performance data
4.4	Assist administrators in getting funding for programs

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*See (p 18:50) for further explanation of this ranking.

When survey respondents were asked about talents or background experiences supervisors should have, they seemed to be indicating what it takes for supervisors to gain credibility with teachers--recent full-time teaching experience. They also revealed the kind of help teachers have said they want when they indicated the importance of other background experiences of supervisors--especially skill in diagnosing individual student learning difficulties, and knowledge of sources of curricular materials. Teachers saw little opportunity or need (we don't know which) for supervisors interpreting testing in the district and classroom. This seemed to say that it is more the responsibility of curriculum coordinators to help fit curriculum to the testing than vice versa. We asked:

> Which of the following background experiences or skills do you think are highly valuable for a (mathematics) (science) curriculum supervisor or coordinator? (Check as many as you wish).

	K-6 Math Supervisors %	7-12 Sci Supervisors %	K-6 Principals %	K-6 Teachers %
Recent full-time teaching experience	89%	59%	96%	97%
Administrative experience	45%	58%	35%	20%
Continuing enrollment in graduate (math) (science) course	43%	19%	31%	27%
Having done curriculum research and development	36%	26%	35%	36%
Skill in diagnosing individual student learning difficulties	83%	76%	43%	83%
Skill in arranging inservice programs	50%	38%	73%	45%
Skill in interpreting test scores for whole classes or schools	54%	53%	30%	42%
Knowledge of recent (mathematics) (science) discoveries	64%	35%	39%	64%
Knowledge of sources of curricular materials	82%	89%	89%	71%
Ability to "speak out" to protect the curriculum	68%	73%	35%	64%

While principals and supervisors divided their opinions, parents thought teachers to be not only in the best position to be knowledgeable about curriculum needs, but also to be the experts, when we asked:

In your district who is the person (or who are the persons) most knowledgeable about whether the curriculum needs improvement of one kind or another?	K-6 Science Supervisors	10-12 Principals	Parents Seniors
Superintendent or Asst or Assoc	11	2	14
Principal	22	13	14
Curriculum personnel	39	19	8
Teachers	49	16	22
Students	2	1	4
No one knows	2	0	1
I don't know	0	1	26
Other	7	1	24

Teachers expressed concern about the lack of material support and with the organizational problems of teaching, less about the poor state of inservice training. Teacher educators had been stressing the importance of inservice training in the next decade, but many teachers did not consider that a major need. Perhaps again they seeing inservice personnel all too seldom oriented to helping teachers with existing problems or with adaptations of subject matter to fit the abilities and temperaments of the students, and not expecting that investment there would pay off.

Support systems were very much a part of the political side of schooling. In ARCHIPOLIS observer Hill-Burnett discussed the impact of decentralization on inservice support (p 9:3):

> From the teachers' point of view, before the "decentralization plan" had gone into effect, the central board of the school system had provided "department" (translate that subject-matter) specialists to go to local schools. Their activities and functions had varied somewhat from elementary, to junior high, to high school. At all these levels, the teachers now expressed some sense of loss about those functions. They still dealt with the district office for support personnel; but the support personnel were no longer categorized by subject, or "departmental," specialization. They further saw the process of securing help from these personnel as a question of new competition for resources, perhaps challenging budget priorities in the local school. The decision about when to call the support service was transferred to the local school and the teachers in it.

In RIVER ACRES, a teacher described to a site visitor the district's policy on supervision:

> *Supervision is "nowhere." The [school] board feels we have too many administrators. They fail to make the distinction between administration and teacher in-service help. This means curriculum construction and implementation is pretty much* editing *in the district office. No help goes to the classroom teacher directly.*

And another said of science activities and investigations; and their implementation:

> *Elementary science is an unnecessarily scary thing for teachers. The technical complexity is not that great. Teachers really do not need to know that much. It is just that we are not prepared to teach it, have bad memories of freshman biology in college, and get no in-service help to speak of (p 1:25).*

Terry Denny commented on one kind of help teachers asked for on p 1:32 of RIVER ACRES:

> Teachers did not call for research or for evaluation of instructional materials or the curriculum. They want help, now. They have three widespread concerns. My notes contain thirty-seven separate pleas (not all elementary) for materials, procedures, aides, or supervision for slow children in mathematics. The harshest self-criticism made was in the mathematics instruction of students in the lower levels.

Teachers there called for inservice cross-grade meetings and vertical communication to replace "failure" of supervision to coordinate the curriculum (p 1:38f).

Continuing Professional Education. Our observers found the teachers engaged in occasional staff meetings, a diminished program of inservice training, and some continued enrollment in university courses. Some districts were increasing the formal obligation of teachers to be explicit about their professional growth goals for the year, but even there the continuing professional education activities were meagre.

Three reasons were heard: (1) the number of inexperienced teachers on the staff was smaller;(2) the incentives for earning course credits and advanced degrees have diminished; and (3) the money available to support resource persons has also diminished.

Staff meetings appeared to be for the purpose of improving organizational arrangements and distributing information rather than for the purpose of giving assistance to the teacher with pedagogical problems.

We heard some comment about increased involvement of union and professional organizations in providing inservice training, but for the most part teachers and administrators expected the responsibility to continue to be shared by teachers themselves and college professors.

To help us understand what school people thought universities might do to assist in inservice training, a Scenario X survey item was put this way:

> One Cyrus Knight School teacher said, "Schools and universities are headed in different directions. Schools want more and more to teach what parents and students believe is useful. Universities want to stress theoretical ideas, the search for Truth." Is this a problem?

7-12 Math Supervisors		7-9 Science Teachers		Responding
N	%	N	%	
36	18%	35	30%	No
24	27%	14	29%	It causes some problems, but that is just the way things are.
15	29%	11	12%	Yes, a problem, mainly because schools no longer see what education is.
9	9%	9	13%	Yes, a problem, mainly because universities just are not interested in people.
44	17%	23	16%	Other

Despite the different educational aims advocated by the curriculum developers and science education specialists, as compared with many teachers in our sites, the differences between most university faculty and school teachers did not appear highly troublesome to these respondents. When we asked what universities could do to help, we found that what is wanted is pretty much what universities are now doing.

What could universities do to be of most help to teachers?
(check only one)

7-12 Math Supervisors		7-9 Science Teachers		Responding
N	%	N	%	
21	23%	26	43%	Develop curricula appropriate to the times
27	13%	16	16%	Run inservice workshops and institutes
26	27%	15	12%	Offer courses oriented to teacher needs
4	0%	5	3%	Establish teacher centers
6	3%	6	6%	Sponsor teacher networks for mutual help
44	33%	23	20%	Other

Survey respondents were also asked about what the federal government could do to support science education teaching in the schools. Four forms of inservice services were ranked the highest:

Hire and pay resource people to help teachers with their teaching skills.
Provide additional institutes for the improvement of teaching.
Develop science courses oriented to present and future job markets.
Provide films and lab materials to schools at low cost or no cost.

We were surprised to find these ranked toward the bottom:

Provide free telephone networks for teachers to help other teachers.
Undertake a public campaign to promote "scientific literacy."
Subsidize the early retirement of ineffective teachers

Because the National Science Foundation has a high responsibility for providing support for science teachers (including math and social studies teachers), we asked about support. Several items in the survey suggested how different groups see ways that a supervisor might be of help to teachers. Math teachers appeared to most want specialists who write and arrange things for teachers. They also expressed interest in help, especially with diagnosis and with other staff development activities. We were surprised to find so little support for teacher-run institutes. Teacher centers were supported more by elementary teachers than supervisors perhaps because such centers operate outside the usual lines of supervision and stress the authority of teachers over the curriculum.

The following support* could be implemented at the district level:

What sorts of support do teachers in your schools need? (check any number)

116 K-6 Math Supvrs N	81 7-9 Math Teachers N	Responding
49	26	specialists who visit each classroom perhaps once a month
59	39	teacher centers where teachers can take their problems
11	8	toll-free telephone numbers teachers can call for help
67	50	a network of teachers willing to help with diagnoses

Which of the following do you believe are of substantial help to teachers having problems teaching basic math? (check any number)

116 K-6 Math Supvrs N	81 7-9 Math Teachers N	Responding
17	12	university courses in math
41	31	university courses in math education
52	36	staff development featuring presentations by visiting experts
90	40	staff development seminars with other teachers talking to a consultant
62	45	staff development workshops involving only the teachers

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*Other teacher suggestions about inservice support activities may be found in answers to open questions in Chapter 18.

What is your feeling about summer institutes such as NSF has sponsored? (These are institutes involving full-time enrollment in special sections of college math or science courses, with some help from education professors.) Check one or more.

116 7-12 Math Supvrs		81 7-9 Sci Teachers		Responding
N	%	N	%	
86	54%	49	53%	They do a good job of giving teachers ideas, contacts, and confidence.
25	25%	10	15%	They are good for good teachers, not very helpful for teachers really needing help.
18	13%	9	9%	They are not as valuable as institutes run by experienced teachers.
66	37%	42	52%	There should be more of them so that all teachers needing them could enroll.

A sizeable proportion of the science teachers in the sites had attended NSF Institutes.* The percent in each category who had been to at least one Institute were:

Teacher sample	Responding yes		Average number of institutes (weighted)
	N	%	
Science: grades 7-9	39	41%	3.0
Mathematics: grades 7-9	24	31%	3.2
Social studies: grades 7-9	7	12%	1.3
Science: grades 10-12	52	46%	1.3
Mathematics: grades 10-12	38	31%	3.2
Social studies: grades 10-12	4	10%	2.5

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*See (p 18:23 for report of data on participation in inservice and preservice courses in addition to NSF Institutes.

A math teacher at WESTERN CITY said (p 7:35):

> *The NSF Institutes that I attended were well worth all the money. I'm sure that if I had not attended these institutes I would not have been able to do as good a job as I have done. A college graduate with a degree in math is not really prepared to teach high school. They don't teach you how to deal with kids and you also don't get much of a chance to get your head together with respect to math instruction. All math teachers should be encouraged to take an NSF Institute at least every five years.*

One negative comment--in reference to a curriculum institute--came from RIVER ACRES (p 1:158):

> *I believe I was lied to at those institutes. The techniques never did work out right back home. Wisconsin and Kentucky teachers said the same thing to me. It isn't the same back home. The deck was stacked somewhere, teachers looked like they were doing things with the kids that they weren't maybe.*

This criticism seems to be more of "the curriculum" than of the institute, however. The positive feeling toward institutes is also reflected by survey responses to an item asking what the federal government should do to support science teaching in the schools. The respondents were to check three things from a list of eleven that they felt most worthy. One choice was "provide additional institutes for the improvement of teaching." The percentages of respondents selecting this choice were:

46%	Administrators
61%	Curriculum Coordinators
31%	Teachers
24%	Students
32%	Parents

Responses to another survey question indicated again the lack of support among teachers for teacher-run institutes but indicated the preference for additional expertise.

That the institutes have been seen to have a good impact seemed clear. Among many federal programs of support for curriculum and teaching, the institutes were mentioned to us most often and in a positive vein.

A science education consultant in a State Department of Education volunteered an observation of support for this point. He wrote:

> *. . . the inservice institutes that NSF sponsors are perhaps the only well planned, well thought out inservice experiences science teachers are exposed to.*

The cynic might say that the positive effect stems from the financial support that teachers received and the opportunity to socialize. Very likely these were factors. But it also seems likely that the respondents were candid when they said that institutes have contributed much to teacher effectiveness--acquainting them with different ideas, content, and techniques or teaching.

We found substantial need for pedagogical support for teachers. Many of the good ideas of supplementary centers, intermediate districts, and teacher centers had not caught on--for reasons we did not understand. But there was a need for materials, for organizational assistance, for relief, and occasionally for help in understanding individual students. There continued to be a very good feeling about the NSF teacher training institutes, and many teachers and administrators told us the "course content" institutes should be extended to the many teachers who ahve not had a chance to benefit from them. Institutes based on the use of expensive materials or new departures for teachers weren't in high demand partly because local funds and innovativeness have ebbed. As a group the teachers we became acquainted with in these studies wanted to extend their continuing professional education. Many felt that additional ways for teachers to share experience and problems needed to be found.

Technology. National concerns about education were not often given focus in the CSSE classrooms, but instructional arrangements made at state and district levels did reflect some national issues. In response to poor student performance on tests, to other embarrassments such as nationally publicized lawsuits brought by nonreading graduates, to a belief that technology can improve the efficiency of instruction, and to a perceived need for more control over the whole teaching-learning system, a nationwide effort has been undertaken to make teaching more explicit, more rational and to make learning more uniform and more measurable. Technology as we saw it did not necessarily mean mechanical or automated devices, but any effort to routinize or standardize procedures either for students or teachers. Thus flash cards, workbooks, and formal plans were as much instruments of technology as computerized math lab and automated reading lab learning systems (p 11:34).

The effort towards systematization appeared to have some effect on what teachers talked about, and some even on what they did. Many teachers appeared to be convinced that teaching and learning should be more efficient. They seemed to prefer efficiency gained by increased teacher control while the districts seemed to prefer gaining efficiency by explication and simplification of what was to be learned. For the most part teachers we saw cooperated with district efforts to improve efficiency through procedural technolization.

In the eleven sites we found teachers using highly routinized instructional procedures, i.e., a technology of teaching. They were structured by specification, hierarchial order, strict time allotments, and the like. They stood in contrast to the more spontaneous and responsive behavior of the Mr. Chips kind of teacher. The highly structured textbook science class in ARCHIPOLIS (p 9:7ff) was a good example of this instructional technology.

We found teachers and other school people largely agreed on the importance of an orderly classroom, objectification of the syllabus, and a strict concern for teacher-time costs, as demonstrated in Scenario W (p 18:44). Our results showed that about half the principals and teachers surveyed agreed with using workbooks, worksheets, and textbooks to keep pupils busy and productive--and our observations and interviews put the support even higher.

This somewhat "industrial" concept of in-class management seemed common. Teachers prepared their schedules to allow for introduction of new material, discussion, problem solving, homework review, etc. A further example of time management was the development and use of prepackaged individualized learning systems.

Whether the curriculum was to be technologized commercially or locally, the first step was usually to obtain widely-acceptable statements of school objectives, reducing the number of paramount things to be accomplished, diminishing the differences to be noted between classrooms and between classmates, and drawing community attention to those school purposes that all agreed upon. The second step was usually to identify criterion performance items, with or without tests, but visible outcomes appropriate for assessing student accomplishment of the objectives. It was presumed that lack of accomplishment would require additional study or that teachers would know how to modify instruction. This remedial part was not as highly technologized, except in certain "individualized" systems such as IPI (which we encountered in ALTE, p 2:14) and Project PLAN (FALL RIVER, p 2:20).

Highly technologized individualized-learning systems like IPI and Project PLAN were being used more as supplemental than central to a district program. (See Chapter 13 section on molecularization and sequencing, p 13:43). Teachers using them some places altered the system of individualized instruction by choosing their own objectives and materials to flesh out the pre-packaged system--for instance in RIVER ACRES (p 1:51). In BRT (p 4:31) though, a contract system was used in which the student and the teacher negotiated the conditions necessary to earn various grades. Although the idea of individualized instruction is that the student can find his/her own way through the system or contract, the RIVER ACRES case demonstrated that accommodation to the demands and requirements of each student's learning was not always smoothly accomplished (p 1:51):

> *If my student is absent when the first cassette in a series is in the room, it is quite likely he will never hear the cassette. If the second cassette builds upon the first cassette, too bad.*

Structured programs aimed at efficiency, uniformity and measurability were not welcomed by all teachers as contributions to learning or to maintaining order in the classroom. In FALL RIVER (p 2:9) one noted:

> *I always thought that the main goal of education was teaching kids; now I find out that the main goal is management.*

The intention of learning systems was to bring efficiency and organization into the classroom. But the systems often proved to be unexpectedly demanding both in the amount of time required to develop or enact the systems and in the time required for subsequent bookkeeping (see p 15:12). Observer Terry Denny commented on the time requirements of these systems in RIVER ACRES (p 1:52) as did observer Mary Lee Smith in FALL RIVER (p 2:3).

Despite these very real concerns with systemized instruction, administrators at many of our sites spoke highly of their technological efforts. Many teachers spoke highly of the increased manageability of instruction through objectification but objected to instructional time diminished by the amount of testing and were apprehensive about what might be done outside the classroom with the test scores. In districts where objectives were formalized and tests were required the teachers were less enthusiastic, but many continued to appreciate the order and assurance that such systems brought to their teaching. We did not run into any situation or even any "folklore stories of far-off places" where the objectives-based systems had in fact substantially changed the achievement levels of the youngsters.

What has been said in this chapter is that it became clear from some of our case studies, some classroom observations by site visitors, some responses to questionnaires, and from tape recordings of site visitor interviews with teachers, that the responsibilities (for which most teachers felt very strongly) regarding the management of the class and the development of study habits and individual personal character were not to be taught just prior to or independent of the subject matter. They were to be an integral part of all the reading. These responsibilities were seen to limit strongly the conceptions of science, the methods of instruction and the materials of instruction. Teachers used the curriculum material selected for academic goals for the socialization of pupils instead, and for developing individual attitudes of responsibility expected by teachers in the next grade. In their "pastoral care" or socialization role, teachers represented adult society "shaping up" youth.

Since there were strong societal, institutional, and professional expectations that subject matter be covered, it was to teachers a matter of efficiency to use the subject matter in part to accomplish socialization goals. But teachers had to develop their techniques for these uses of subject matter largely on their own or with the help of other teachers in the same school, because neither preservice nor inservice teacher education programs provided much help. Some found assistance in technology for their difficult socialization and intellectual goals and most searched for more help from wherever it might come.

Chapter 17

THE SCHOOL AND THE COMMUNITY

The management of social institutions in technologically-sophisticated societies is a most complex and difficult task. Educational institutions are no exception. Our case studies dealt predominantly with formal education in science, mathematics and social studies--but seldom were matters far removed from the problems of managing the school system.

What our eleven school systems had in common, though varying in size and kind, was a large number of people organized into a social unit, a unit established for the explicit purpose of achieving one primary goal: educating youth. Because schools have been formally organized, not just the product of random pressures, they are expected by policy-makers and the man on the street to have been consciously planned and fitted with programs to guide the instruction of pupils.

The planning is ever imperfect. Management--school administration--always has the problems of staff selection and retention, maintenance of the physical plant, financing, organization and reorganization, programming, and student enrollment. It faces the task of satisfying many groups of people--people who have different ideas about the proper and improper goals of public education. We see these goals, the stated and the unstated, reflecting the ideas and influence of teachers, boards of education, parents, businessmen, professors of education, advocacy groups, religious groups, athletic groups, aesthetic groups, and of course, funding agencies such as the state and federal government. And management has its separate goals too. It is a strong political context in which we find the schools. Congressman Richard Bolling recognized it:

> *I would hope that all of you who are disillusioned by the political process, who think you can escape the political process, would recognize that the framework of the society within which you work and plan is based on the political process.**

But there are two very large and surprisingly separate political processes. There is a local political-social reality of the school. There is also a national political-social reality of the schools altogether.

The school of the local community is one thing. The schools of the nation are something else. Somehow, the aggregate of all the local schools is just not what "our national school system" is.

It is partly of course that our schools are not only the creation and vital organ of the local community, but also of outside agencies and interests, governments, suppliers, real estate interests, etc. But there is a more important distinction between this whole and the sum of its local parts. The people see the local school through the medium of personal contact, direct and indirect. They see the national educational system almost entirely through the news and entertainment media. And the two percepts are different in content as well as scope.

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*Richard Bolling, Address presented at Research Utilization Conference, Kansas City, Missouri, October 7-9, 1968, in Preliminary Report of a Research Utilization Conference (Kansas City, Missouri: Institute for Community Studies, February 1969), p. 26.

It is not unusual to find citizens and teachers thinking of the local schools in terms of taxes, rowdy behavior, sports, and the like. Taxes continue to increase, some bond referenda are voted down at the polls. Some of the new programs in the schools look pretty good, though it seems extravagant to put carpeting on the floors. Many of the youngsters continue to go off to some of the best universities. There is that one school bus they had to put a policeman on. It is sometimes black against white. But the football team has both blacks and whites on it, and they work together pretty well. Such are typical thoughts about the local schools.

And to the extent that they think about the national school system, (which seems not to be very much) they think of what is said in the newspapers and on television, that the U. S. Supreme Court is going to decide whether or not it is all right for less qualified black kids to go to medical school when more qualified white kids are being turned down; that the test scores have been going down for several years; that youngsters who cannot read but who graduated from high school are suing the school for not teaching them to read; that the courts are making the schools use busing to integrate the schools even though almost everyone is against forced busing.

No matter how you add up the local teaching and learning situations, the concerns and accomplishments of youngsters and their teachers, they neither provide the assessment of education we have come to expect from the news media nor face up to the problems that national critics have vividly revealed. Planners of national education programs should be knowledgeable about both realities, the local and the national.

As has been pointed out in eleven case studies and all the preceding assimilation chapters, the teacher in the local school has his/her mind on local problems. We look next at staffing, management, and community relations--conditions that shape each local school's science, math and social studies programs.

STAFFING THE SCHOOLS

In most of our case study sites grade school enrollments were dropping and high school enrollments were starting what is expected to be at least a ten-year drop. In most of these districts the size of the teaching staff has dropped, but to a lesser extent. Attrition of teachers and other staff due to retirement, withdrawal, and promotion has resulted in replacement by transfers within the system more than by new hirings.

There is no typical situation, however. Two CSSE districts were vigorously recruiting new personnel. Another, one of our largest school sites,hired only two new teachers during the year of our observations. The principal of still another school said she could not keep qualified mathematics instructors because the local technical industries paid them so much more.

One school was keeping its enrollment relatively constant by admitting more students from other subdistricts within the city. Some students transfer in because of the facilities there for physically handicapped students. Another school was finding students transferring back to the public schools from the white academies since parents now see racial integration as less abhorrent than they did a few years ago.

Each place has its own circumstances, but by and large, enrollments in most places are going down and will continue to go down. It affects what the districts do, what the teachers do, and what the curriculum is. Wayne Welch, our field observer at the URBANVILLE site, observed:

> The average age of the faculty continues to rise and no new teachers (those entering directly from college) are added to the faculty.

An older, more experienced, less mobile teaching force is not necessarily a problem. But these circumstances narrow the options a district has for deciding what kind of a teaching force it wants. And the unions are at work to limit them further.

Protecting Jobs. It is reasonable to suppose that the number of teachers will be a function of the number of children there are to teach--unless you are one of today's teachers. The teacher works hard, and expects to be rewarded with job security. The teacher thinks, "At last enrollments have dropped to twenty-eight per room. It's still too many to teach in one room. How can they talk about laying off teachers?"

The administrators of the schools see enrollments going down and, with state financial support based on an enrollment formula, they look for a way to trim school costs. With over sixty per cent of total current expenditures* committed to instructional staff** salaries, many do talk about laying off teachers. Declining enrollments are less common in Sun Belt cities and some rural districts. And over half the superintendents responding to our questionnaire said they had not recently had budgets cut; but holding down costs and expecting fewer state funds were common and serious topics of conversation in the schools we observed.

The American Federation of Teachers and the National Education Association have helped teachers increase salaries, for example, from a national average of $7,423 in 1967-68 to $10,114 in 1972-73*** and more since 1973. But they have not in the last decade kept up with wage levels of other public employees such as firemen and policemen**** or the average wages of the American craft union workers.

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*National Center for Education Statistics, Statistics of Local Public School Systems Finance, 1969-70, p. 16.

**Professional instructional staff is defined as teachers, principals, assistant principals, supervisors of instruction, guidance and psychological staff, librarians and audio-visual staff.

***National Center for Education Statistics, Digest of Education Statistics (1973), Table 57.

****For 1972-73, firemen's minimum salaries averaged $9,515 and policemen's minimum $9,963; average maximum salaries were $11,604 and $12,330, respectively. Minimum scheduled salaries for teachers with bachelor's degrees averaged $7,357 for the 1972-73 school year, and maximum scheduled salaries for teachers with a doctorate averaged $14,562. In the five-year period since 1968, the annual rate of increase for policemen's and firemen's minimum salaries was 7.4%, while maximum salaries rose (footnote continued on next page)

Important also to the teacher has been the effectiveness of the unions in protecting teaching jobs. Just ten years ago in most communities a teacher's contract was negotiated on an individual basis. The board had to show little cause for not continuing the employment. Legally speaking, few teachers have tenure today, but the grounds for dismissing a teacher are few and difficult to prove.

As a result of union action, many districts have strong seniority clauses in teacher contracts. The protection is likely to increase as additional states pass compulsory arbitration laws. City schools in URBANVILLE opened late in 1976 because of a strike brought by teachers. One point of contention was a seniority matter, with the union demanding more systematic and coherent procedures when teachers were to be "not rehired." When the strike was settled the union had won more complete dependence on seniority. No value judgment was to be made as to who should and should not be fired.

In our URBANVILLE site it was apparent that the old teachers stay and the new teachers go. Even if the new teachers were to be especially good at any recent thrust of the school, such as the teaching of reading or an emphasis on applied mathematics in such a district--one whose budget requires a reduction in teaching force--the new teachers are the ones who will be told in April that their contracts will not be renewed.

At our URBANVILLE site and elsewhere the school system holds diminishing control over probably the most important determinant of good learning--the teaching positions.

The Urge Not to Change. Of course there still is some turnover. When September 1978 arrives, about five per cent of the 1977-78 staff at a typical school will be gone--promoted, retired, transferred--for some reason leaving a vacancy. Each department, each administrator, has an idea of what kind of person could best fit. Chances are, in most districts, it will have to be a transfer from an overstaffed school or department.

An unprecedented number of certified teachers seek employment. The proportion of education graduates obtaining teaching jobs dropped from seventy-four per cent in 1962 to forty-eight per cent in 1974.* New York City found many in the unemployed teaching pool unwilling to take unexpectedly offered teaching assignments, but the security of the positions offered was low. Some say it should be a time of opportunity for school systems to upgrade their faculties. Clearly there are more capable teachers available to replace the "least effective" ten per cent of any district's classroom teachers.

We did not become aware of an effort at any of our sites to identify the least effective teachers and replace them. Lou Smith described the situation (see p 3:84) in ALTE, our suburban site in the Midwest. He left little doubt that there is fairly general agreement about which of the teachers have "gone stale." The problem, many agreed, is not one of identifying those who are not "strong teachers," but a mechanism for replacing or revitalizing the less effective.

(footnote continued from previous page) at an annual rate of 8.2%. Since the 1967-68 school year, teachers' minimum scheduled salaries increased annually by 5.5% and maximum salaries by 5.8%. Negotiation Research Digest (April 1974), p. 15.

*R. B. Freeman, "Investment in Human Capital and Knowledge" in Capital for Productivity and Jobs, ed. Eli Shapiro and William White (Englewood Cliffs, N.J.: Prentice Hall, 1977) p. 105.

But that too is an oversimplification of the problem. There are many definitions of effectiveness in teaching. And most people will not consider "instructional effectiveness" as a criterion until other qualifications have been met.* It was obvious in each of our sites that the school systems try to hire the "best qualified" candidate from that subpool of applicants who clearly fit into the existing dominant value system of the community. Often, acquaintance with the community is considered an asset for an applying teacher. In one of our sites there was a resentment against a black teacher recently transferred to a predominantly white school, not because he did not know how to teach science, but because he "did not seem to know how to work with youngsters, not, at least, with the kind of youngsters they had at this school."

The main reason teachers are not released if they can be protected is the institutional ethic. If any one is threatened then all are threatened. A sense of loyalty is highly desired, and rating some teachers as more effective than others runs counter to that loyalty. Some parents try to challenge that institutional ethic, but seldom successfully. Three parents in URBANVILLE were talking to the interviewer. One said that weeding out bad teachers did not work

> *because somebody knows somebody, or somebody's scared to do something and no one takes any action. They're afraid of repercussions. . . . I've worked very hard to bring to their attention certain discrepancies in a teacher's attitude and treatment of children--and got nowhere. I was told that the principal had to support his teachers even though he knew I was right.*

Another said:

> *It's impossible to fire anyone.*

And the third replied:

> *I don't want to fire these teachers. I just want them to shape up.*

But in most places the teachers do closely fit the neighborhood majority group's image of what a teacher should be professionally. The large criticisms come from an occasional minority or from those talking about the distant mass of teachers. Boston University's Education Dean Robert Dentler asked:

> *What can people do? We're in a situation where, on many fronts, courts are becoming the last resort for parents and their complaints.***

There is little enthusiasm for affirmative action, except among those groups who would themselves benefit. Almost everyone wants to give the job to "one of our kind." In rural places a board member sometimes sees the job opening as a chance to employ a needy acquaintance, the wife of a friend perhaps, or a relative. Even though a typical, elaborate testing and interviewing procedure was used to screen applicants in our Pennsylvania and Alabama sites, we found the ties of kith and kin throughout the systems.

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*Even then it is recognized that effectiveness in instruction is not a uni-dimensional trait. Ineffectiveness is evidenced by poor performance in one or more of the many responsibilities of an instructor.

**Newsweek, 12 September 1977, p. 70.

Alan Peshkin, our Illinois field observer, once reported (in a case study of another rural site, in press) why a broadly-experienced aggressive young man was passed over as candidate for that district's school superintendent. One board member acknowledged that the other, the successful, candidate had less of a record, adding: "But he's country!"

We saw the same phenomenon in Texas, Alabama, Illinois, and California. In each case the strong teachers were described as being "right" for their school and communities. To many people at our affluent midwest suburb--with its bright, upper middle class children--"right" meant something like "proven ability to provide mental and physical discipline and to produce hard-working students without shouting, paddling, or squelching curiosity." Such criteria have been at work for a long time. Except in a corner or two of the community there is little yearning for change in criteria. The new teacher usually will not be different from the old.

Enrollments decline, and it might be expected that fewer teachers would be needed to "do the job." But the regular teachers have tenure--legally or by custom. There is little turnover because teachers do not see good prospects for alternative employment in or out of education. With schools closing rather than newly building, with teachers hanging onto their jobs, with more and more issues subjected to contract negotiation, an administrator or education official desiring to bring new blood into teaching finds distressingly few positions to fill. According to the dynamics we observed in nine of eleven sites, the teacher situation is "a constant." The future in a Sun Belt boom-town such as RIVER ACRES, Texas, is less apparent. Elsewhere, the teachers a citizen sees in school today are pretty much the teachers who will be teaching there in 1985.

MANAGEMENT

According to administrators the problems of the schools are basically not curricular or pedagogical. We heard in URBANVILLE:

> The big issues here are teacher displacement (the teachers don't know whether they're going to be back next year or where), declining enrollments, and corresponding reduction of staff. Desegregation has been a problem, and probably will be even more. Increasing numbers of demands placed upon the schools, e.g., special education classes, desegregation, trying to solve discipline problems. . . .

As they saw it, if students are not learning science and math it is largely because outside pressures and inside disrespect for authority prevent the schools from operating according to design.

Until the most recent years school managers have been expected to design school operations to be more flexible, to accommodate a more heterogeneous group of students and a more varied curricular program. As public concerns about the cost of running schools and about the low performance scores of students have increased, the managers have faced (and raised) increasing demands for "accountability." This appears to be, in Pentagonese, a "no-win" situation. To concentrate on bringing up minimum scores will alienate the middle and fast learning students, and probably bring down the test averages. To concentrate on the average student, as they have in the past, will provoke both the fast and slow students, and the "study ethic" of the school will further deteriorate.

There probably is no way, in this permissive culture, with the increasing requirement for heterogeneous grouping for instruction, that the managers and teachers can get tomorrow's students to perform up to yesterday's standards. Yet management is expected to try and they do try. They find it difficult to tell us of the impossibility of our expectations or the expectations raised by advocates of new programs. The lesson is clear. Few who do try to tell us to be realistic about what schools can do are still in top positions.

School management in this country sees public approval and financial support as imperative to the smooth running of the schools. Financial aid, program changes and additions, and reorganization all require extensive cooperation within the school and monitoring of community toleration on the outside. In order to meet these demands, interesting and worthwhile ideas in their own right such as outdoor education, photo studies or music are touted as solutions to existing problems. And promises are made that are probably impossible to fulfill. For instance,

> The superintendent of a major midwestern city, eyeing a large unexpected budget surplus, promised his board that if he could spend it on special instructional centers, he would bring the test scores back up where they had been several years before. (R. Stake's notes.)

Due to consolidation and population growth, school districts are larger than twenty years ago. They handle more pupils (although fewer than in 1971), more personnel, and more money. As expressed in the RIVER ACRES report the larger the system gets, the greater the "felt need" to manage. In some cases the school system budget is larger than any industrial budget in the community. The expectation for technical management expertise is great.

Technical Specialists. Increasingly, the educational administrators of the past have been succeeded by management specialists, a new breed of technical people. They may hold doctorates of philosophy but they are not philosophers. It may be a change for the better. The technical demands on managers are most real. There seems little disagreement among people that we should have well-trained technical people running our schools. Nothing in our experience in eleven districts suggests that philosophers could run today's schools better.

Many citizens do not see a substantial difference between running a school and running a factory. The learning factory metaphor suggests technical expertise as a solution to many demands. Most administrators seemed to accept and use this metaphor. Technology was repeatedly put forth by them as the way to get the most for the taxpayer's dollar. In education, technology can mean the use of equipment in lieu of direct teacher-student contact; it can mean the specifying of behavioral objectives; it can mean promoting a referendum for school financing; it can mean organizing the in-service training program.

We have learned that instructional technology often comes as more costly rather than less. In many schools we visited we found instructional use of television, tape recorders, math labs with electronic machines, hand-held calculators, and even television production equipment. In no place did this mean fewer teachers, less costly instruction. In ALTE and VORTEX it meant a higher adult-youngster ratio, more teacher aides or clerks, but no fewer teachers. It may have resulted in more relevant learning experiences for the students. It did not mean that traditional objectives were being pursued at a lesser cost.

When there actually is the introduction of instructional hardware, e.g., movie projectors, language labs, teaching machines and other technical equipment, specialists are needed to instruct adults and children in their use and care. And they require administrators who understand the importance of experience with technical equipment (not only to work and preserve this equipment, but because maintenance is a part of general education today). Educational experience with technical equipment is possible and important. Technical equipment is unlikely to be the solution to poor reading scores or budget problems, regardless of what the IBM television commercials say.

But the understanding of what technical instructional equipment can and cannot do is not the sense in which today's school administrators are technicians. Their expertise is the expertise of the bureaucracy. It is used to prepare statements to get federal grants or special allowances from legislatures or city councils. It is used to organize offices to comply with federal and state requirements. One GREATER BOSTON interviewee said:

> *There is all kinds of federal money floating around, but there is a lack of basic and continuing support.*

It is the obligation of the contemporary administrator to see that none of that money floats on past. And to put it where it is needed.*

The coordination of teachers, children, clerks, and support personnel; the supervision of budgets, buses, books and buildings; and the communication with parents, community leaders, and government officials are difficult, demanding and consuming work. As one GREATER BOSTON administrator suggested:

> *A fast moving school isn't run just by humanizing the administration [a popular concept in the '60s].*

But how then should it work? Today's hue and cry is for accountability, for the evaluation of outcomes (usually defined as some measure of student competence), for the balancing of costs and benefits. This same administrator had questions about that also. Observer Mary Lee Smith reported that the writing of behavioral objectives at FALL RIVER was successful, but the implementation was not (see p 2:3). There appeared to be no penalty for setting up an impractical technical system.

We found little evidence that administrators care one way or another about science education. Science education is seldom promoted as a matter of "sound education." Management is the friend of science education when its aims and activities are important to parents, those who want their youngsters to enter engineering schools, medical schools and liberal arts colleges. Or it is important when the dispensing of funds is a national priority as in the post-Sputnik days. Science education is not easily adaptable to the existing problems of community support, financial need or re-establishing a curricular emphasis on the basic skills.

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*One federal research project undertook to find if general financial aid to highly impoverished schools could raise the level of student achievement. In the pilot study the researchers found that school administrators in fifteen pairs of elementary schools were able to divert at least as much funding to the control schools as was provided by the federal government to the experimental schools. (In the subsequent comparisons the federal government allocation was over $500 extra per youngster in the experimental group and the local supporters only came up with $129 extra per youngster in the control group.) We concluded, with at least a glimmer of admiration, that the administrators involved were more concerned about improving the funding for all the children than in researching the effects of special funding on the achievement of those children. The research was reported in: John Coulson, et al. Third Year of Emergency School Aid Act National Evaluation, USOE Contract LEC-0-73-0831, OEC-0-73-6336, SDC-TM-52-36/014/00 (Santa Monica: Systems Development Corporation, March 1977).

Patterns of Organization. A variety of reorganizations at the district level was found in the case studies. Some were precipitated by judicial decree for the purpose of desegregation (GREATER BOSTON and PINE CITY). Others represent the influence of demographic shifts with declining enrollments (BRT, URBANVILLE, VORTEX) or increasing enrollments with an influx of white middle class northerners into the southwest (RIVER ACRES, FALL RIVER).

Declining enrollments were handled in several ways. The smallest site, in rural Illinois, which had already passed through an earlier phase of consolidation, was anticipating that dropping enrollments--a manifestation of cumulative change in land use--would compel still another consolidation. Or a new form of governing unit, the "Intermediate Educational Unit," might emerge as it has in Pennsylvania, Oregon, and New York. To date, intermediary "districts" have functioned as a support system to local schools, and their role has been to deliver services to schools with limited student enrollments in specialized areas.

Some districts may be anticipating a combination of effects such as declining enrollments and desegregation (COLUMBUS, URBANVILLE, WESTERN CITY) or consolidation by law (ALTE, GREATER BOSTON) to promote desegregation or to equalize taxing revenue. In districts with a rapidly expanding student enrollment reorganization may be found in the form of sections of a district seceding from a larger system (RIVER ACRES).

All of these reorganizations may entail the physical closing of neighborhood schools (or the emotional abandonment of the neighborhood school concept). Talk about school closings antagonizes teachers (anxious about transfers and seniority) and parents (anxious about students sent to strange and distant places and the future of residential and business areas). Of course reorganization also is seen by some as part of the community's power struggles. The struggles might be especially heated if intermediate educational districts are reassigned primary responsibility instead of support responsibility for the implementation of certain laws such as PL 94-142 or where consolidation reduces the number of administrators. Curricular improvement seems quite unlikely during contentious reorganization periods.

But there are other reorganization attempts directly intended to centralize the development, planning or revision of curriculum and/or decentralization of the administrative authority structure. We found this in RIVER ACRES, VORTEX, ALTE and URBANVILLE. We found decentralization of administrative authority in ARCHIPOLIS. Both reorganizations were occurring simultaneously in FALL RIVER. Administrative decentralization efforts in ARCHIPOLIS included the ordering and distribution of supplies and services such as textbooks and lab equipment--as well as the distribution of extra help in the form of teachers with subject matter specialization.

In this particular case the principal and teachers seemed to appreciate the effort toward decentralization regarding decisions and responsibility, but the new system also left unfulfilled certain functions performed by the old.

The organizational structures of the schools were not probed or reported much in these case studies because that was not a primary aim. It was apparent that reorganization efforts in these sites were found to expose priorities and realities that previously had gone unstated and unquestioned. Accountability and formal evaluation systems do the same. Our observations of them will be presented next.

ACCOUNTABILITY AND EVALUATION

For a long time schools have been expected to account for the taxpayer's dollar--in bookkeeping terms. More recently, the critics of the schools and the managers of the schools have called for accountability for the student learnings purchased with those dollars.

While we found only a small amount of talk about accountability at our case study sites, almost nobody questioned the assumption that an accountability system should be pressed upon the schools. No one said, "I wonder if the school people are getting so nervous about their obligations that they are actually doing a poorer job." Or, "We know that in some communities, some students are graduating from high school even though they are not capable of reading and doing arithmetic. Are the teachers responsible for this?" When school personnel in our national survey were asked why such graduations occurred, only ten per cent felt the teachers were incompetent. About thirty-five per cent thought the teachers were too lax. They checked other reasons such as "government regulations, laws, and court rulings are making schools promote unqualified students" (fifty-six per cent) and "the schools just push 'poor learners' through to get rid of them" (sixty-five per cent). The aim of accountability is to curtail such graduations and other forms of poor learning, regardless of who is responsible--but the message of accountability is a message to the teacher to do something.

What does "accountability" offer to a teacher as a concept? One thought is that it may offer more authority to teachers. An URBANVILLE Educational Association president endorsed accountability, claiming it "will become a reality only when and if more professional autonomy is achieved." Another interviewee felt it offered security (site visit report):

> *Without [accountability] we're propagating our own ignorance because we have no consistent structure. And there's great insecurity in having no positive direction.*

Schools, they say, have an obligation to show that students are becoming more competent--but how to go about achieving accountability is not something that any of our schools had demonstrated in other than the old intuitive ways.

Obviously, formal accountability depends on a means for evaluating, for discriminating among programs, teachers and students. Almost all the districts we visited had created "evaluation offices" of some kind. The ones in COLUMBUS and ARCHIPOLIS had credible national reputations. The personnel assigned to perform evaluation duties at several sites confirmed the impression that they were concentrating their monitoring on students more than on teachers and programs. Monitoring of students was found in WESTERN CITY, URBANVILLE, and RIVER ACRES in the form of "minimum competency examinations." Criterion referenced diagnostic tests were conspicuous in ARCHIPOLIS. Pretest and post-tests were in use in the math labs at VORTEX. Standardized achievement tests were administered at all of our sites.

Performance-oriented evaluation can be built into many instructional programs--performance contracting was one brief-lived effort. At the time of our observations we found organized efforts (in the form of teachers writing "behavioral objectives" and curriculum guides) at FALL RIVER, RIVER ACRES, ALTE and ARCHIPOLIS. At times various consultants and publishers had been found to provide checklists on instructional effectiveness of classroom management and record keeping for the evaluation of teachers. We found most schools using something that the teachers had created or borrowed, and modified. In ALTE they had taken a non-quantitative, yet sophisticated approach. In this comfortable suburb evaluation data included supervisory, collegial, and client feedback. (It is nicely described on page 3:77.)

We found no actual evidence of validity of these accountability procedures. But neither the teachers nor technical people at the district were seen to be raising questions about validity. They made sense to some, and few others protested. In most places the autonomy of the classroom was protection for the teacher reluctant to go along.

Criteria. Student achievement testing--albeit an important evaluation technique--is only one way in which people at our sites were attempting to meet the accountability demands. For instance, a teacher in Colorado said:

> *Schools should teach the value system that is consistent with the community.*

The language of accountability systems emphasizes independent, objective criteria, but the interviewees told us of "dependent" criteria, dependent on the reasons the community supports the schools. When telling us of how their schools are or are not living up to expectations, teachers, administrators and parents happened to cite:

--cleanliness and orderliness of the school (BRT, ALTE, RIVER ACRES)

--judicious selection of teaching ideas and materials, "We don't buy everything that comes along." (BRT, RIVER ACRES)

--offering advanced placement courses (BRT, VORTEX, ALTE, URBANVILLE)

--the advanced placement test scores (VORTEX, RIVER ACRES)

--national merit scholars (RIVER ACRES, URBANVILLE)

--a balanced budget, "We educate within our means, facilities, talent and the capacity of the populace to support." (BRT, COLUMBUS)

--the math labs (VORTEX, ARCHIPOLIS)

--homework, not too much and not too little (BRT, RIVER ACRES, ALTE)

--keeping students, especially seniors, working hard (FALL RIVER, RIVER ACRES)

--achievement in science fairs (BRT)

--achievement in music and art (ALTE, GREATER BOSTON)

--environmental education (FALL RIVER, ALTE)

--a full program of courses (ARCHIPOLIS, WESTERN CITY, ALTE)

In four of the places we heard someone say: "If the community is quiet it's a good sign that we are handling things okay."

In GREATER BOSTON we heard: "Program success is relative to what went on before and what would go on without the program." Success was often described as improvement in the atmosphere, climate or attitudes of classes and students. A better atmosphere was said to be indicated by:

--fewer discipline problems or fewer absences (GREATER BOSTON, ARCHIPOLIS, WESTERN CITY)

--fewer children leaving the public for the private schools (PINE CITY, URBANVILLE)

--fewer dropouts (GREATER BOSTON, ARCHIPOLIS)

--accessibility of school administrators (ALTE, BRT, ARCHIPOLIS) but not over supervision (URBANVILLE, FALL RIVER, RIVER ACRES)

--whether or not the kids enjoy the classes (ALTE, RIVER ACRES, GREATER BOSTON)

A rationale for the evaluation of teaching was expressed back in 1968 as researching how "teaching behavior style A is likely to enhance student competence B, in students of Type X, who find themselves in an institutional context of Type Y in a social setting of Type Z."* And many of the school people we talked to did think that way (GREATER BOSTON):

> *I don't want to make any grand claims for the system. I just know at this time, in this school, with these students it works.* (GREATER BOSTON)

But to operationalize this statement is another matter**. Ratings of schools, programs, classroom events, and teaching may correlate with achievement scores, but what to do about low ratings is unclear or may be too painful to consider. It certainly does not mean that school people and community members do not have any idea about what they want when they see it. They do.

> *This is the kind of system we want, the kind of people who should staff it, the kind of teaching, learning that should be going on and these are the ways we're going to achieve it.* (ALTE)

Informal evaluations of school programs have been going on for many years, and continue in much the same way. More and more teacher time was being spent for formal evaluation. Often it was introduced with the claim that it was needed for accountability. When discussing accountability we heard teachers talk about minimum proficiency in math and reading. The topic of science education almost never came up in the same conversation.

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*Betty Humphry, Preface to The Evaluation of Teaching: A Report of the Second Pi Lambda Theta Catena (Washington, D.C.: Pi Lambda Theta, 1967).

**Lee J. Cronbach, "Beyond the Two Disciplines of Scientific Psychology," American Psychologist 30 (1975): 118-127. Also in Evaluation Studies: Review Annual, vol. 1, ed. Gene V Glass (Beverly Hills, California: Sage Publications, 1976).

ADVOCACY, APATHY, AND CRITICISM

A number of reports on the American high school* have been issued in recent years. An excellent summary of them can be found in The Educational Forum dated March 1976. An earlier edition contained an article entitled "The High School as a Marginal Institution." Consternation has been expressed in the professional press as well as the popular press about conditions in the secondary schools, indicating at least among some people a growing fear that it is becoming of marginal value to American youth, and consequently to the larger society.

Few parents and school people we talked to in our eleven sites viewed their high school as a marginal institution. Many saw the public schools somewhat diminished in effectiveness and no longer quite as central to the education and maturation of youngsters, but clearly still the primary institutions for most young people. Criticisms were relatively few partly because children of the majority of families are successful in their young lives, and the schools apparently contribute something to that success. In the majority of the other families it is presumed that what their children need is something that the schools give the more advantaged children but somehow do not give theirs. So rather than wanting the schools to change they want to get their share of whatever it is. There was less criticism at the community level of the schools than one would expect by reading and watching the national news media. Still, there were numerous criticisms and numerous advocacies voiced by teachers and administrators as well as parents and students.

There are a number of factors outside the control of the individual school itself which may have influenced the estrangement of the parents. In PINE CITY, for example, the desegregation rulings and the subsequent flight to the white academies were seen as weakening the community support of the school and the push from home for the student:

> *Parents can influence science in school. But we have very little response from parents here. We don't even have enough parents to have a PTA here. Parents who would be interested send children to academies . . . We have three private schools in town, and a lot is taken away [from the public schools].*

Court-ordered busing, which often carries a child to a school some distance from home, also has the effect of diminishing the involvement of the parent and attenuating the sense of community, with resulting effects on the teacher in the classroom.

In our visits to eleven sites we refreshed our awareness that parents of low and middle class status will mobilize to protect their neighborhood schools--as an anti-integration measure (GREATER BOSTON), for decentralization of urban authority and increase in control for minority groups (ARCHIPOLIS), and just because it is comforting to know that the children are not far from home (GREATER BOSTON, ARCHIPOLIS and everywhere else). Parents will rise up to save athletic programs and to pass or reject bond and tax referenda (URBANVILLE). We know from the newspapers, though not from our visits, that occasionally parents strike down curricula dealing with evolution or the relativity of values.

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*Of course there is no single American high school or school system. They vary in character, in personality, and in behavior as much as the families on any block. They have common problems, common schedules, common accoutrements, but are increasingly different as one comes in close to examine them. So the criticism and the praise for the schools fit no school perfectly, and fit many very poorly.

Occasionally the family institution set out to shape the educational institution, advocating a certain curricula emphasis such as creative writing, advanced placement courses, career education, or advanced courses at an earlier grade level. One teacher in ALTE said, "The parents like to have a lot of science early. So we do a lot of science." But not at the sacrifice to high standards or eligibility to college. "They [the parents] still want to see those grades." In situations such as ALTE the parents see themselves as collaborators both in instruction and gaining community support.

But the only advocacy that spread to all situations, east and west, rich and poor, was the advocacy for a basic curriculum, the emphasis on reading and computation for all grades past kindergarten.

> *I think going back to the basics is a wonderful idea. I come from Ireland . . . and I never saw such poor spellers or such poor readers. When my son was only eight years old, he skipped two grades and graduated from high school at sixteen. I couldn't believe it because he wasn't a bag of brains.*

Some have called this kind of advocacy a form of apathy.

> *If parents have lived with the child all this time without finding out that he cannot read, there is plainly another problem here that has nothing to do with the schools.**

Criticism, apathy, and advocacy are related matters. If community and schools are pursuing a mutually-desired outcome the effort is lauded as cooperation. Intemperate and stubborn citizens who work for these common causes are widely applauded. When citizens are pushing the schools farther or faster than most people want to go then stubbornness and intemperance are seen to be offensive. In this section we have recorded some of the voices that have been raised in support of and in opposition to local science programs--and have noted as well the more common finding of parent apathy about what is taught in the schools.

Parents. Schools sometimes are seen as overly vulnerable to public criticism and parental pressure. We saw evidence of this in ALTE, FALL RIVER, and RIVER ACRES. Sometimes schools have been criticized for not being responsive enough. We saw this in GREATER BOSTON, URBANVILLE and WESTERN CITY. But in each place, of course, the schools were some of both.

There is always a question as to what the proper role for a parent is. According to the formal rhetoric parents are expected to help in setting policy, evaluating curriula, orienting children to their studies, and helping on special occasions. Certainly in most schools, the support of parents is solicited and their help is needed. Parents are often asked to sit on committees setting broad goals for the schools. But almost never are they expected or allowed to play an integral part in the management of problem resolution. The reasons are obvious: too often they do not appreciate the complexity of the situation, too often they press for personal favor, too seldom is there time to engage them, too seldom do the parents care.

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*Dorothy Wilson, Maine Times, 30 September 1977.

In some places we visited the parents were described as apathetic. Teachers and administrators expressed dismay that the parents did not involve themselves in their children's education. These school people sometimes saw the school as a different kind of social service organization, one with expertise in "parenting," instructing parents how to involve themselves in the education of their children. We saw this in GREATER BOSTON, PINE CITY, VORTEX, and WESTERN CITY. Within this definition of parent involvement, encouraging parent action did not usually include encouraging parents to be involved in decision-making that could potentially change the direction of the school.

The pressures for parent involvement usually took the form of how to help a child with homework and encouragement for regular attendance. Parents were encouraged to attend parent-teacher conferences. A parent explained the high-need/low-success of such efforts in ARCHIPOLIS this way:

> *Many parents did not help the teacher or talk to their children about schoolwork because they were ashamed to reveal how little education they had.*

Obviously, there would be other reasons for the appearance of parent apathy, and indeed what appeared to the teacher as apathy may be something quite different.

Our field observer in ARCHIPOLIS examined the condition carefully and in one instance said:

> The greatest concern expressed by parents centered on their efforts to correct problems perceived or observed in schools. The "Catch 22" quality surrounding every attempt to get things changed made them feel powerless against the system and ineffective as one of the partners in the schools' efforts.

Teachers in many of the CSSE sites spoke wistfully or even bitterly of lack of support from the home. They saw it creating a sense of isolation which had negative effects on educational achievement. In the PINE CITY site visit, a general science teacher, talking about a particular group of students, said:

> *These children do not have the push from home that my better students have had. You can tell--if the parents are concerned, the kids are going to be working.*

The parental pressure that is observed (we heard in the same discussion) is not directed to science:

> *I get the impression that most of the parents are concerned with the basics. . . . If a child gets a "needs improvement in reading" compared to a "needs improvement in science," they're much more concerned.*

However, some reported parent apathy even as to reading. At BRT we heard:

> *One of the biggest problems with reading is parents don't have time to listen to their children read.*

They complained too that parents don't read to their children. It was attributed at least partly to the impact of TV. From a PINE CITY math teacher we heard:

> *You're going to find that a vast majority of our parents cannot even tell you who their students' teachers are or what subjects they're taking. I imagine that 75% of our report cards never go*

> *home. They're signed by the students themselves. . . . The parents are caught up in a financial situation and social situation, and it's a dog-eat-dog world out there and they're just not spending as much time with their children as they should.*

Some parents agreed that parents as a group were negligent as to their child's education:

> *The little ones need to be helped with their flash cards. A lot of parents won't take the time.*
>
> *We blame the teacher that our child isn't getting this, but we won't say, "how much is 3 times 1?".*
>
> *I don't feel the schools can do everything--it's just too big . . . there are so many things the schools can't teach. I feel like the big breakdown is parents.*

We heard dissenting opinions too. The math chairman at the same site said:

> *In many of the homes, there's a strong emphasis on learning.*

It's important to note, however, that this same person earlier had been talking about a loss of academic perspectives, non-motivated students, and students in algebra who shouldn't be there. He also took a negative stance on social promotion. In fact, this comment on the family emphasis on learning was the one bright spot in his otherwise dismal scene--and in fact is a bit difficult to reconcile with those facts. The social studies teacher at BRT also spoke about community pride in the school (see BRT, p 4:29 and p 4:41).

Some teachers felt there was not only a clear abdication of parental responsibilities but also an attempt to shift these responsibilities to the school. During the URBANVILLE site visit we were told:

> *In the years I've been teaching, it seems to me that more and more through the years the schools are expected to do a lot of things that parents should be doing. The parents will come to school and say, "Well, I can't make him do this. Good luck." Like do his homework or read a book. . . . I think it's a mistake to expect that we can solve all the problems a child has while even solving his academic ones. . . . Parents have to assume more responsibility for the education of their child. . . . There has to be more involvement.*

Some at BRT took a philosophical view of all of this:

> *There's nothing you can really do about the home, so you have to make the atmosphere in the school. . . . You have to make up any lack [that occurs in the home]. (p 4:43)*

Estrangement and Indignation. Why have the parents not been more vocal than they have in influencing the local curriculum? We did not directly pursue this question, but encountered various suggestions. In two of our sites we scheduled open hearings at which people could come and express themselves. No parents or out-of-school people came. We arranged to talk to other parent groups and asked why no one came. They guessed that no one expected that it would do any good.

The ARCHIPOLIS teachers were having trouble getting parent chaperones to accompany field trips. One parent speculated that parents there were reluctant to reveal how little they knew about things. Teachers had trouble getting those parents to help with homework too. Several teachers commented that this situation had become worse with lessons that are different from those the parents had in school.

Changes in the curriculum as well as changes in the disciplines themselves seem to have made some parents feel incompetent to help the child at home:

> *With this new math, I don't help my children out from the seventh grade on up and I think a lot of parents feel that way. They just don't understand; it's not what they learned. The wording of it, more than the math, is different.*

This is probably not a trivial effect. In the past, when children had problems with specific subject areas in school, the parent could often explain it in a way that made it clear. By not having this backup system (the parents) available, the schools have lost a valuable source of support in this one subject area, at least, and children who might have gotten certain concepts with a bit of additional help from their parents do not. Furthermore, this has no doubt fed into the disinterest and alienation that many parents seem to feel vis-a-vis the school system.* At one of the site visit meetings in RIVER ACRES, a parent speaking about math said, "I'll leave it to the teacher," and was greeted with a round of sympathetic laughter.

A factor that is controlled to some extent by the individual school is homework. If it is not given, one of the major means the parent has of monitoring what goes on in the school is removed. One RIVER ACRES teacher recognized the parents' insistence on monitoring (p 1:51):

> *The eighth-grade text does not meet the needs of anybody. It is about college level. The society in which we teach dictates the use of a textbook, however, so, even thought I don't use it in class, I send it home every now and then to keep my parents at bay.*

However, the following quote also from RIVER ACRES makes it clear that the relationship between assigning homework and maintaining some degree of parental support is not necessarily a direct or simple one (p 1:14):

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*The Carnegie Council on Children Report contended that schools and other social institutions function in such a way as to make it very difficult for families to cope with them let alone support them. See Kenneth Kenniston, All Our Children: The American Family Under Pressure, The Carnegie Council on Children (New York: Harcourt, Brace and Jovanovich, 1977).

> *Homework that is busy work is trash. Teachers wonder why I don't ask my children to finish it. I don't think it is worth doing, that is why. . . . I don't want to minimize the problem. I just hate not supporting homework. . . . but when it comes down to a silly geography cut-and-paste-the-rivers project and attending the Houston symphony my daughter will go to school humming Chopin the next morning.**

This statement is an interesting one. It shows not just lack of support, but a clear overriding of the prerogative of the school to assign homework. The parent apparently felt competent to make decisions about what scholastic activities are, and are not, instructionally worthwhile for her child. Furthermore, she may be providing her daughter with a model for interacting with the school. It supports the view that the growing distance from parents that many teachers feel is a complex phenomenon, and one that will not easily be resolved.

The BRT superintendent touched several possible explanations when he discussed homework:

> *I looked at the amount of homework that students take home today versus when I was in high school--and they don't have homework like we did. The teachers for one thing, don't believe in it as much, at these smallish schools. . . . Parents really object to homework and the teachers say that a lot of the students won't do anymore. I feel this is a little alarming, in a way.*

To what extent the proximity of the home and school as well as changes in curricula, the disciplines themselves and the assigning of homework, are causes of the schism which seems to exist between many parents and the teacher in the classroom, and to what extent they are simply indications of a deeper disenchantment with both education generally and the work ethic, we cannot say. There is certainly evidence in the case studies and from the site visits that both are involved.

New names for subject matter or courses and the "alphabet soup" of PSSC, Title IX, and 94-142 further weaken the self-confidence of some parents. Terry Denny reported that one Texas parent who avowed she could not help her child with language arts was surprised tc find that it was just another name for spelling, grammar, and reading (p 1:23). At another level, an Illinois science teacher proposed a science course for adults to get them to the level of their children:

> *I'd like to be able to teach adult science education. So much has changed since the parents of today's kids got out of school that their kids probably know more about science than they do.*

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*The reader is urged to consider the full quote in the RIVER ACRES case study, (p 1:14).

Even in a "progressive" district such as ALTE the parents resent some efforts to change the schools. A principal said:

> *Parents are committed to graded education. You can change anything else--space, curriculum--but not ungraded or a mix of grades. We tried that ten years ago. . . . We had a big room of second and third graders and for years afterward everything was blamed on the "big room."*

The reader of all eleven CSSE case studies will not draw the conclusion that 1976-77 was the year of parent indignation. Rather, each site had its stories of years past, when parents rose up to oppose the "big room" or the closing of a school. Four years ago white middle-class parents removed their children from the newly integrated public schools in PINE CITY and only now are starting to return. In FALL RIVER parents invaded classrooms to see what was going on when a new instructional method called PLAN was introduced--it has since been reduced in scope and parents have been permitted to opt their children out.

Most of the parent criticism is general. A young parent said:

> *I don't think kids are always taught how to learn. . . . When I went to (the) state university, I found out I didn't know how to study. I had absolutely no concept of how to study. I had never done it, I had never needed to do it, I had never been pressured into doing it.**

Valuing Science Education. From our interviews we found the parents interested in talking about the curriculum in-the-large and seldom with much to say about specific courses. Most thought that science education was important, especially for the college-bound. For the rest of the children it was important too but not much time should be spent on science if reading or computation skills needed working on.

We were perplexed by this. We wondered if school leaders really did not see science and science education as being important. We asked a random sample of school superintendents across the country the following question:

> For many students the science goal "understanding the world in which we live" seems remote and impractical. Students now enroll in few science courses unless required to. Less science is being taught now than in earlier years. Do you think this national trend will have serious negative effect on . . .

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*It was clear how teachers respond to such criticism, whether or not it applies to them. In part, it drives them to stick ridigly to textbooks and syllabi, in part it drives them to freeze the curriculum in ways reminiscent of Benjamin's Sabre-Toothed Curriculum, a satire depicting cavemen who taught techniques for thwarting sabre-toothed tigers long after they had become extinct.

	said "yes"	said "no"	said "don't know"
... the growth of technology in our society	74%	20%	6%
... the economy of our country in years ahead	71%	19%	10%
... military preparedness in this country	57%	33%	10%
... the "quality of life" in this country	79%	15%	6%

(Of 150 superintendents sampled only 74 responded; one of these omitted this entire item and another omitted the last two parts. The percents above are based on those superintendents who responded to that part of the item. Standard errors are in Chapter 18. Results have been weighted according to RTI sampling plan.)

When we asked, "Should the schools try to do something to reverse the trend away from science?"

59 superintendents checked "yes"
9 superintendents checked "no"
and 6 superintendents checked "don't know."

Noting that only half of the superintendents responded and reminding ourselves that there are many more small districts than large, we concluded that the superintendents of most of the school districts do feel that the trend away from science education will have a serious negative effect on the well-being of our country, and that the schools should try to reverse the trend.

With such a strong inclination to see the deterioration of science education as a serious national problem, one would wonder why they do not speak out in their districts more for science education. In not one of our CSSE districts was the superintendent known to be an advocate of science education more than something else. The problem is that superintendnets as well as the rest of the school people have largely accepted the position that students cannot learn science until they have shown proficiencies in reading and math.

This struck us as equivalent to putting a low priority on science. It seemed obvious to us that most children would never master reading and computation to the satisfaction of a science teacher who had such prerequisites. It seemed that the only way to teach most children science is to begin teaching them before kindergarten and during every grade, along with reading and computation, relying on those skills possible, but not waiting on them.

Some teachers and administrators do see it that way. The national survey data presented in Chapter 14 show a clear division between teachers who believe that the concepts and complexities of science should be taught from the outset versus those who would teach skills first then the complex subject matter.

Another issue that had strong implications for the science curriculum was the interest people had in vocational education versus liberal arts education. Many parents wished that the schools would be more concerned about getting students ready for vocational responsibilities, and many school people agreed. Naturally, most of them did not see an obvious role for science courses when the task was getting non-college-bound Johnny ready for the job market. Yet 2/3 of our parents and teachers felt that some proficiency in science should be a requirement for high school graduation. Another perplexing situation. Of course, it is easy to say that children ought to be required to learn everything that was, is now, or ever has been in the school curriculum.

Results from survey questions on the importance of a vocational orientation in American schools are presented in Chapters 12 and 18. By and large, parents saw the responsibility for vocational preparation as more important than school people did. But few appeared ready to sacrifice any of the scholastic program in order to get youngsters more ready for jobs. They seemed not to see it as a trade-off. The more important different tracks and different programs they expected to be continued. They seemed to feel that the ideal program would graduate every boy and girl fully prepared in the learning skills, knowledgable in the traditional subject matters, eligible for college, and ready to take a full-time job.

From other questioning it was apparent that administrators and parents were concerned about youth unemployment and the hollowness of the admonition that "if you don't do your schoolwork you are not going to be able to find a good job." But there did not appear to be a strong feeling that the schools can do much about making the courses more vocational. Here again the belief was that work on the basic skills is most likely to be of value to the employment-seeking youth.

The schools, as agents for socializing children in the values, myths and ethics of the dominant culture of their own communities, are also expected to produce change in preparation for the unknown future. Each community struggles with it. Parents and teachers alike fear they might be subverted by reform, be it integration (PINE CITY, GREATER BOSTON), open space instructional settings (VORTEX, RIVER ACRES), ungradedness (ALTE), or innovative curriculum (FALL RIVER, WESTERN CITY).

Preparation for the future is more often thought of as the working career, not of the future social order (PINE CITY, FALL RIVER). Perhaps there are enough other institutions worrying about the future social order. That future our parents seemed not to concern themselves with. The expectation that the schools prepare children for their future work does not always include the need for having the latest teaching techniques or special programs, certainly not giving up discipline, hard work, stress on the basic skills, or achievement in the traditional form of test scores. As one well-educated black parent said:

> *One cannot honestly and realistically conclude that science teaching is occurring at (this school) if one expects most students to be prepared to deal with science at a level of expectation that is functional now and in the future. However, if one feels that the personal involvement and choices of students is more critical to the life chances of these children, (this) way might be the way to go. I would not want the experience for my children for I cannot afford the risk.*

To get an overall, most general feeling as to how good (or how bad) people in and around the schools perceived their curricular programs to be, we asked the following question in our survey:

> Even though it cannot really be summed up in a word, what do you feel is the overall quality of the high school science program?
>
> ___ excellent ___very good ___satisfactory ___poor ___other

We asked the same question regarding the high school math program and the high school social studies program in the district. The median responses were as follows:

	Science	Math	Soc St
Parents	Satisfactory	Satisfactory	Satisfactory
Seniors	Satisfactory	Very Good	Very Good
Teachers	Very Good	Very Good	Very Good*
Coordinators	Very Good	Very Good	Very Good
Administrators	Very Good	Very Good	Satisfactory

*but close to satisfactory

Very few of the respondents used any category other than satisfactory or very good to describe the curricular programs. Even though most people were able to tell interviewers or to describe on the survey forms some shortcomings of the courses, their overall summary of the high school programs was that it was at least satisfactory.

SCHOOLS AND CHANGE

Paradoxically, schools are the agents of change and the deterrents to change. The communities we visited are troubled in many ways, would like relief from their troubles, and occasionally see the schools as a potential contributor to the relief. Different people see different troubles, so there is no universal mandate. What one person would like to have changed would upset another. The remedy that one person has in mind would further upset another. Few people in the schools we visited are interested in creating a new society. Most spoke in support of returning to a better day, how it was, or perhaps how it seemed to be.

Social Change. The society changes the schools and the schools are called upon to change the society. Since World War II two long and trying episodes, the Cold War and the Civil Rights Movement, have greatly increased the federal and direct societal involvement in schooling.* The Cold War set the stage for federal involvement through its demand for technical manpower, a demand that seemed to call for better science and mathematics curricula. The leadership of our society answered the civil rights demands by committing the schools to racial integration and the reduction of poverty through basic and vocational instruction. Schools have recently been used as a major instrument to respond to widely recognized national needs.

The people, including the professional educators, by and large supported Cold War efforts, and were enthusiastic about adding additional courses and ways of teaching to further that cause, and perhaps even to improve education for other purposes too. The people, including the professional educators, were considerably less enthusiastic about the integration of the schools and the responsibility for teaching children unready or reluctant to learn. They turned against the curriculum reform movement when they found it at odds with their purposes and difficult to manage. They came to accept programs for poverty children because the programs brought in federal money, but they were dismayed by the problems accompanying that instruction. We found the people at our sites, in and out of school, not much interested in desegregation and war on poverty, but greatly interested in an emphasis on the basic learnings and concerned about how the schools will pay their bills.

The idea of making the schools the instrument for adapting to social change may overestimate the schools' ability to remedy social ills. There were some bright spots. The social barriers (not the economic barriers) for blacks appeared to be succumbing to school efforts in PINE CITY, Alabama. Control of the school system by blacks was increasing in ARCHIPOLIS and the GREATER BOSTON high school we observed, but even that slow change was not matched for Mexican-Americans in WESTERN CITY and RIVER ACRES. The disparity in economic opportunity and social privilege is not noticeably improved even though all of our schools' clusters had some involvement in federal war-on-poverty aid-to-education except ALTE and the Hardy cluster in URBANVILLE. The traditional view of our schools has been that they were the key agent in transferring the country from a manual-agrarian society to an industrial-commercial society, which we presume we wanted to be--therefore, the schools should be able to transfer us into anything else we want to be. It does not seem to work out that way.

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*Joel Spring, The Sorting Machine: National Educational Policy Since 1945 (New York: David McKay Company, 1976).

This is not to suggest that the schools should not be participating or even leading in the efforts of a nation to improve itself. We should change our schools in terms of what is morally right as well as what is instrumental to change. The schools should be agents for improving the margins as well as the center, and the success of the system will be put to the test with its minorities: the blacks, chicanos, emancipationist women, handicapped and others. The schools should reflect our ideals. But our visits to eleven sites helped persuade us that too much of the improvement of our society was being assigned to the schools--and the school people were resistant to the assignment.

We were satisfied with the efforts of these schools to act as a forum for ideas of social change. The discussion of social reform was not as prevalent there as on television and was usually couched in traditionalist-value statements, but the debate was curtailed mostly by a reluctance to "get off the subject" of the regular lesson* rather than a reluctance to consider the social problems that needed correction. The debates that do occur may be a greater contribution to social change than either its role in desegregation and in economic reform for the issues of desegregation, poverty, sexism, special education for the handicapped, sex education were raised by the students and the teachers in the schools we visited.

Education is an institution. In this country it is a traditionalist institution. Public schools are organizations. We found them to be committed both to the service of society and the protection of themselves as organizations. They are social systems within the social system, enrolling 89% of all children between the ages of five and seventeen. This school age population is 25% of the total population.** In these schools the children learn who they are and who they are not; they learn ways of becoming somebody else and they learn the obstacles to becoming somebody else.

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*Many would argue that at least in the social studies the social change topics should be the lesson. We found essentially no advocacy among teachers, administrators, students, or parents to decrease the concentration on history and abstract political systems in order to spend more time on contemporary social issues in the social studies.

**10.5% of all children are enrolled in private schools, making 99.8% of all children between the ages of 5 and 17 enrolled in school. National Center for Educational Statistics. Statistics of Trends in Education, 1965-66 to 1985-86.

The schools continue to build their own social and instructional technology. They work hard at defining teacher, administrator, pupil, specialist, classroom, grade, and course. At the district level they are so formal, so well organized and defined on paper that they are easily identifiable and therefore vulnerable to attempts at manipulation. The purpose is to make them more manageable to administrators outside the school building, but they thus become vulnerable to management (manipulation) from any outside political forces. It is not surprising that, as observer Mary Lee Smith noted in FALL RIVER, Colorado (p 2:1):

> People outside the schools have relatively simple ideas about how schools work: to change education in a desired direction, one must merely manipulate one or two variables.

But any changes that must be made will be influenced by other changes taking place.

Our study was not a longitudinal study, so we had to rely for perceptions of change on what we knew to be true earlier at other sites and what our respondents told us. But we have little doubt about changes that are occurring in the following:

--in unionization of teachers, especially in VORTEX Pennsylvania, URBANVILLE Washington, COLUMBUS Ohio, and ARCHIPOLIS on the eastern seaboard

--in open or informal instructional arrangements, especially in our midwest suburb ALTE, RIVER ACRES Texas, VORTEX Pennsylvania and FALL RIVER Colorado

--in the size of school districts, especially at BRT Illinois, URBANVILLE Washington, RIVER ACRES Texas, and FALL RIVER Colorado

--in the source of funding, increasingly from federal and state sources, with accompanying restrictions for its use, at all our sites

--in the amount of desegregation in PINE CITY Alabama and in the GREATER BOSTON site

--in the use of automated and electronic equipment in VORTEX Pennsylvania, and at ALTE, our midwest suburb

--and in the use of special personnel, such as aides, in our GREATER BOSTON site, in VORTEX Pennsylvania, at ALTE, our midwest suburb, and at WESTERN CITY California.

These changes by and large have been structural changes within the educational system itself. They are changes that stand on their own and cannot be totally judged by outcomes in instruction. Unionization will affect teachers' income and ideas about work load--we do not have measures of educational quality or student achievement that are sensitive to their more indirect effects. It would be simpler if we could use such outcome measures, as critics and allies alike sometimes suggest we should, but the effects on the schools and effects of the schools are parts of many social purposes, not just of getting children instructed. Science education and desegregation are now both purposes of the schools, sometimes they will be unrelated and sometimes not. In one of our sites we heard:

> *We would never have had a specialty program in chem technology if it weren't for desegregation. . . . We're enlarging the chemistry facilities at the magnet school and we're developing additional curriculum.*

It is difficult to consider the relationships of school and society by any small number inventories, tests, and social indicators.

In our CSSE schools we found change and we found stability. Generally the schooling process remained the same:

--the teachers were in control of classrooms

--the teachers identified the textbooks as the authority on knowledge

--emphasis was given to working hard, keeping busy, being polite, competing, aspiring to improve, working independently, and preparing for things to come

--the lessons were to follow an order, curricular things had their place

--a single dimension of work quality, graded usually from A to F was sufficient to evaluate students of diverse backgrounds, interests and modes of expression.

But even with this stability, in every site teachers, administrators and parents were saying that the children have changed. In many respects they do not like the change, even discounting the fact that no older generation probably has ever approved of change initiated by the younger. Each generation clearly sees that the younger folks do not work as hard as they did. And now children are seen to lack motivation, concern about the future, and respect for authority. "They think too much about cars. They go off around the world. They don't settle down to a real job." Teachers are as dismayed by this view as other adults are.

Most teachers feel that there is not much the schools can do to bring about social improvement. The case studies of FALL RIVER and GREATER BOSTON spoke of these limits, though without a strong sense of discouragement. At all the sites we found people feeling that the changes were happening too fast--that the schools could scarcely keep up, let alone lead the change toward the better or head off the change toward the worse.

Since schools participate in social change as a result of forces outside the community more than of those within, it is more a matter of when, where and how much change rather than whether or not at all. The PINE CITY Alabama school was ahead of the white community in the area of desegregation and was careful to hold the line elsewhere, both academically and socially. After thinking about these forces, ALTE observer Lou Smith wrote (p 3:26):

> The local district arrangements in curriculum and teaching--science education if you like, are not happenstance, not chance, nor accidents, but the resolutions of individual choices, contending points of view, and differential power. NSF (and the other outside groups) become a fourth category of contestants with its own resources and rewards, its own point of view with all the internal consistencies and inconsistencies, its own skill in persuasion and influence.

As more agencies express concern and attempt to help in the remedy, the feeling within the school is that control and hope for improvement are being lost.

Academically the desired change today is in the production of better achievement test scores and directing children's learning toward things most adults are familiar with. Change is desired for keeping up the advance of science, whether on environmental issues (so noticed in FALL RIVER and ALTE) or with regard to the traditional route to college (so much a concern in URBANVILLE, WESTERN CITY, VORTEX, and RIVER ACRES). Socially the desired change is in responsibility to majority community values by local communities and to pluralist groups by national groups. Most people want "all of the above." The argument starts when we talk about how to get them all. One science teacher in URBANVILLE said:

> *It's okay for them (minority students) to be here but they better understand that they have to live up to our standards.*

A less frequently heard voice replied:

> *It is time we recognized that a pluralistic community means that different standards are okay for different people.*

With such pervasive and subtle disagreements as to the desirability of social change it is not surprising that the schools have a confused and problematic role in our contemporary society. And of course, the confusion spills over into the traditional role of the schools to provide instruction and educational opportunity to the youth of the country.

Curriculum Change. In an article which asked: "Whatever Happened to Curriculum Reform?" Donald Schön wrote of his concerns about past efforts to fashion nationwide curriculum changes.* He specifically noted the roles of NSF and the science "establishment" in the course content improvement effort of the last two decades. This M.I.T. philosopher of science speculated:

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*Donald A. Schön. "Whatever Happened to Curriculum Reform?" National Elementary Principal 56 (September/October 1976): 31.

> *What would it be like to make implementation or adaptation central to the enterprise? How might a central institution take on the role of providing the framework, tools, means of assessment, and resources to local schools so that they can become more competent at adaptation or implementation and indeed at design?*

As indicated several pages earlier, the purposes of local practitioners are not always in tune with curriculum specialists or leaders in science. In fact, much of the literature about curriculum reform alludes to the unwillingness of teachers and administrators to pursue the aims of those on campuses and in agencies. The presentation of the previous chapter, that the problem is less one of willingness than of contradictory purposes, has implication for future plans at reform.

The dilemma presented to federal agencies was nicely put by Ernest House:*

> *. . . Most innovations as now advanced are shaped by the producing system rather than by the people who must use them. One can create new medicines and try them out without any understanding of the human body, but that is not always an effective or wise thing to do. The receiving organism must be understood and respected.*

These CSSE case studies, as well as other parts of our report, lend much credence to the observations above. Organizational barriers to educational reform are particularly formidable in the United States. The late economist E. F. Schumacher underscored another dimension to the quandary. Cautioning that new legislation or policies are only preparatory measures, he stated: "New methods of organization are required, because the policy is in the implementation."** (his italics) A report of the Education Commission of the States spoke of the resulting condition.

> *Many innovations in instruction which have been introduced in order to satisfy the demands of parents and students have been found wanting. One of the reasons why so many innovations have failed may be the fact that they are introduced into a matrix of the traditional form of governance in education.****

There are those who feel that educational management may be becoming politically sophisticated--with the expectation that fewer "non-implementable" programs would be legislated in the future.

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*Ernest R. House, "Transferability and Equity in Innovation Policy," mimeographed (Urbana: CIRCE, University of Illinois, 1976).

**E. F. Schumacher, Small is Beautiful: A Study of Economics as if People Mattered (London: Blond & Briggs, 1973), p. 188.

***Intergovernmental Relations and the Governance of Education: A Report to the President's Commission on School Finance, Russel B. Vlaanderen and Erick L. Lindquist, Education Commission of the States, Denver, Colorado, 1972, pp. 4-5.

> *It is clear that localism continues to hold significant symbolic value in American federalism, but has more persistent operational consequences in education than in any other sector of governmental activity. . . . When federal funding at long last became available education was catapulted into intergovernmental administrative arrangements that were already familiar in other sectors, improvisational and unwelcome as they may have seemed to educators. Now that the initial shocks have subsided, the latter have begun to develop political skills and wrestle with concerns comparable to those of other participating sectors, trying to sort out the dilemmas of centralized policy making and decentralized delivery of services, modes of accountability, and meaningful citizen participation.**

Several "targets of opportunity" for productive--and needed--research are sketched in the Executive Summary of this CSSE Report. Many other CSSE observations have implications for an NSF research program. As one illustration, growing concern among many citizens relative to the desirability of small-scale, community based programs and services is apparent in the same historical moment when pent-up demands for equity are adding new layers of managerial functions to the burdens assumed by public schools. What are the implications for research, policy, and practice?

Contrasting viewpoints of the dynamics surrounding curriculum change appear below. The portrayal they offer holds unique salience for the National Science Foundation. Richard Carlson said:

> *Modern math does not call upon the school system to provide a completely new service or teach a new subject. Modern math is a new way of ordering and teaching a firmly established part of the school program. To adopt modern math a school system generally accepts new textbooks and other instructional material and provides some retraining of teachers.***

But Seymour Sarason said:

> *Many teachers are in trouble with the new math. Second, the sources of trouble are many but among the most important are the consequences of how it was introduced to teachers, and the difficulty teachers have in voicing questions, problems, and doubts which they fear will*

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*Edith Mosher, "Education and American Federalism--Intergovernmental and National Policy Influences," The Politics of Education, 76th Yearbook of the National Society for the Study of Education, Part II, ed., Jay Scribner (Chicago: University of Chicago Press, 1977), p. 118.

**Richard Carlson, Adoption of Educational Innovations, The Center for the Advanced Study of Educational Administration (CASEA) (Eugene: University of Oregon, 1965), pp. 14-15.

> *be construed as a lack of intelligence and competence, and the tendency on the part of administrators and supervisors to relate to teachers in a way conducive to one-way-conversation.**

Certainly most of our observations have been in line with Sarason's appraisal. A more recent publication of his treated "the myth of unlimited resources" allegedly guiding reform efforts in the 1960s, and called for more use of "networks,"** His exploration of "mesh (saturated) networks for diffusion of innovations or cultural norms" deserves further study. It appears closely related to the earlier work of Swedish geographer Torsten Hagerstrand and his American interpreters.***

Universities and curriculum reform funding sources confront the possibility of serious "mismatches" between current arrangements for institutional services and emerging social problems, Schön asserted.**** Recent struggles with educational dissidents and social critics on the one side, and fundamentalist groups and their Congressional allies on the other, have made NSF officers aware of the consequences of controversial "mismatches." Several years ago, Dean Robert T. Schafer of Teachers College, Columbia University, cautioned that universities face many dangers in trying to provide services (including curriculum development to meet the broad-based needs of public school children).*****

> *Since basic knowledge in many areas is lacking, much so-called educational service consists in reality of providing pseudo-authoritative answers to questions not presently capable of resolution. . . . This kind of so-called professional service can only dissipate the energies of a university faculty.*

Even the appraisal of educational needs may be an inappropriate task for university research and development teams. Lee Cronbach cautioned that educational evaluation "is first and foremost a political activity, a function performed within a social system."****** We submit that the CSSE studies clearly document the need to examine the "system requirements" of schools as political-social institutions.

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*Seymour Sarason, The School Culture and Processes of Change, The Henry H. Brechbill Lectures, University of Maryland, 10 January 1966, p. 16.

**S. Sarason, C. Carroll, K. Maton, S. Cohen, E. Lorentz, Human Services and Resource Networks, (San Francisco: Josey-Bass Publishers, 1977).

***Two of Hagerstrand's publications stand out: The Propagation of Innovation Waves (Lund, Sweden: Royal University of Lund, 1953); and Innovation Diffusion as a Spatial Process (Chicago: University of Chicago Press, 1967). Ernest R. House, The Politics of Educational Innovation (Berkeley, Cal.: McCutchan Publishing Corporation, 1974), is one who has explored Hagerstrand's theories.

****Donald A. Schön, "The Technology of Public Learning," 1974, (mimeo, p. 3).

*****Robert J. Schafer, The School as a Center of Inquiry (New York: Harper and Row, 1967), pp. 75-76.

******Lee J. Cronbach, "Remarks to the New Society," Evaluation Research Society 1 (April 1977): 1-2.

Chapter 18

SURVEY FINDINGS AND CORROBORATIONS

Elizabeth Knight Dawson

PURPOSE OF THE SURVEY

Case Studies in Science Education was one of three projects funded by the National Science Foundation to assess the status of science education* in American schools.

> *The purpose of most investigations...is the collection of information which will provide a basis for action, whether immediately or in the long run. The investigator perceives a problem which, in his view, requires solution, decides that a particular study will contribute to this end, and embarks upon the study. If he is blessed with a creative turn of mind and a modicum of luck, and if he plans his study soundly, the findings may well be of wide scientific interest. If he is less inspired, but selects a problem of practical importance, and if he plans his study soundly, the findings will be useful ones, though of less wide interest.***

Few would disagree that the subject of science education as it currently exists meets two of the criteria for a study that leads to findings that are both useful and of wide interest. Science education has its share of problems, some that relate to education in general and some that are specific to science itself, and these problems most certainly are of practical importance.

The survey activities resulted from the combined efforts of many of the project staff. Beth Dawson coordinated the survey and authored the findings reported in this chapter. The Director of the project, Robert E. Stake, was responsible for developing the majority of the questionnaire and originated the scenario format. Almost all project staff were involved in field testing and revising the scenarios. The direction of the survey administration and analysis were greatly assisted by Jennifer McCreadie who supervised the mailing, follow-up and coding of the questionnaires as well as analyzing and summarizing the free response items. Charles Secolsky was most helpful in assisting with the computer programming and analysis of survey data.

*Throughout this report, science education is used to include education in the natural sciences, mathematics and social studies.

**J. H. Abramson, Survey Methods in Community Medicine, (London: Churchill Livingston, 1974) p. 1.

The major activity of the Case Studies in Science Education project was to identify and study educational issues of national concern. Ten districts in the United States were selected, and later supplemented with an eleventh district, for a four to eight week on-site observation study. During one or more periods of on-site observation a site visit team consisting of project personnel and experts in science education visited the district. The issues and insights resulting from the observations and the case study visits have been detailed in the remainder of this report. The present chapter describes and presents findings from the third phase of study, a national survey of educators, administrators and consumers of science education.

The overall objective of the survey was to inquire into complex and subtle issues commonly involved in teaching and learning in problem-ridden times. Many of these issues did not originate in science, per se, but have appeared at the eleven observation sites and are influencing the quality of course offerings and teacher services. It is our hope that the case study and site visit reports and the results from the national survey provide the National Science Foundation with greater insights into the complex conditions and issues in science education for grades kindergarten through twelve in the United States today.

The specific purposes of the survey were three fold: to give confirmation or disconfirmation to the extended observations earlier made by the field observers in the eleven selected districts; to identify the diversity and nuances of views held by people in and around the classrooms in this country; and to obtain suggestions as to what steps might be taken by agencies such as the National Science Foundation to remedy the more tractable difficulties.

One of the major advantages of survey research is that a great deal of information can be obtained from a large population without the expense of either a complete census or direct observation of the variables under investigation. Additionally, if samples are properly selected, the information is reasonably accurate--within sampling error, of course. However, survey research also has distinct disadvantages that must be recognized. Probably the most important is that information obtained by this method is superficial in nature and does not penetrate into the issues being studied. And there are other problems: bias on the part of respondents may make the results invalid; questionnaire items may be incorrectly interpreted; sampling errors may be greater than estimated.*

The methodology of the entire study is detailed in Chapter C; the specific method used in the survey is described on the following pages. If care is taken in the interpretation of the survey results and if they are contrasted and integrated with the conclusions from the case study observations, we expect that the findings of the Case Studies in Science Education project will be useful and of wide interest--both to the National Science Foundation and others concerned with science education.

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*Fred N. Kerlinger, Foundations of Behavioral Research, 2nd ed. (New York: Holt, Rinehart & Winston, 1973), pp. 410-423.

METHOD OF SURVEY

Instrument Development. Issues relevant to science education were identified at the eleven sites by experienced ethnographers and drafted into scenario form by project personnel. The scenario form was developed as an attempt to communicate the complexity of an issue to respondents by incorporating the issues in a hypothetical setting or situation. The situation is really a contrived illustration and provides a background against which questions relevant to the issue may be projected. Thus, a given scenario consists of two major sections: a situation designed to provide stimulation to discussion and a series of questions raised by or related to the situation. While the scenario content was chosen on the basis of the case study experiences and attempted to reflect a wide range of educational issues, it should be noted that time constraints required the major instrument development activities to be completed before all of the field observations were finished.

The survey instrument itself consists of four pages and has three major sections. A sample questionnaire, designed specifically for one of the twenty-two respondent groups is included as an appendix to this chapter. The first page contains demographic, biographic and experience-related questions designed specifically for the respondent group to which it was administered. This page also contains one or more general issue-oriented questions that may be common to more than one respondent. The analyses of questions from this page of the questionnaire are presented in the section entitled: Responses to Demographic and Experience-Related Questions of the present chapter.

The second portion of the questionnaire is on pages 2 and 3 and consists of a scenario and related questions. Eight scenarios were developed; each was administered to two, three or four respondent groups. The content of the eight scenarios is briefly described below along with the respondent groups to which each was administered. The analyses of the scenarios are presented in the section entitled: Responses to Scenario.

The final section of the questionnaire is on page 4 and consists of general items regarding science education. Three distinct fourth pages were designed and each design was printed on one-third of the questionnaires for each respondent group. Results are presented in the section entitled: Responses to Science Education General Questions.

There was no attempt to include all possible response categories for each item on the questionnaires. Frequently, interest centered on the number of people who would select categories that were of particular interest in this study. The "other" option was thus included on many items so that respondents would have a place to register their feelings if they were different from the categories provided.

The division of the questionnaire as described above was done in order to accomplish several goals. First, it was desirable to collect demographic and experiential data that vary from respondent group to respondent group; thus the different forms of the first pages. The scenarios were assigned to specific respondent groups on the basis of relevance and in order to obtain a diversity of opinion on various issues. Each scenario was assigned to only a small number of groups in order to maintain a reasonable length of the instrument. Finally, it was desirable to have a number of items that would be administered to larger samples and would include respondents from all groups. Three distinct fourth pages were therefore designed to provide responses to a larger number of general questions on science education.

Two pilot administrations were performed on the questionnaires with subsequent revision of instruments following each. A total of 133 persons in various subgroups were included in the pilot administration. Seventy-five percent of the respondents reported that they completed the questionnaire in 25 minutes or less.

Sampling and Administration. The general groups surveyed include district superintendents, principals, curriculum supervisors, teachers, high school counselors, senior level students and their parents. The sampling of all but the last three groups was performed by Research Triangle Institute, creating subsamples of those drawn by RTI for the National Science Foundation survey of materials usage in pre-college education. The use of the RTI sample permits generalization to the national population. A multi-stage stratified cluster design was used with the primary sampling units defined as 100 geographic areas. Within each primary sampling unit, four school districts from both the public and private domains were selected with probability proportional to the total district enrollment. This sampling procedure required weighted observations to estimate population values. Further details of the RTI procedures are outlined in their proposal No. 22-77-09-01.*

The generation of the Case Studies in Science Education (CSSE) subsamples is presented in schematic form in Figure 18-1 and briefly described as follows. From the RTI sample school districts, approximately 500 in number, a sample of 149 superintendents was generated. Three principal samples were selected: those of schools containing any of the grades kindergarten through 6; those of schools containing any of the grades 7 through 9; and those of schools containing any of the grades 10 through 12. Principals of schools containing grades in more than one of the above divisions (e.g. a school with grades 9 through 12) were randomly assigned to only one category. This procedure resulted in principal sample sizes of 94, 86 and 87 respectively.

The RTI supervisor sample consisted of those persons who had curriculum coordinating responsibilities in the 500 school districts, and included a number of individuals who were also teachers, principals and department heads. Each of the approximately 1000 supervisors in the RTI sample was assigned to one of the following groups according to the subject and grade range of responsibility: science supervisors (grades K-6), mathematics supervisors (grades K-6), science supervisors (grades 7-12), mathematics supervisors (grades 10-12), and social studies supervisors (grades 7-12). Persons responsible for K-6 social studies only were omitted from the sampling process. This procedure resulted in superviser sample sizes of 210, 198, 200, 211 and 201 respectively.

Seven teacher samples were generated on the basis of subject and grade range. These were elementary teachers (n=150); from grades 7 through 9, science teachers (n=150), mathematics teachers (n=150) and social studies teachers (n=75); from grades 10 through 12, science teachers (n=150), mathematics teachers (n=150) and social studies teachers (n=75).

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*Research Triangle Institute, A Proposal for Survey of Materials Usage in Pre-College Education in the U.S.: RFP 76-108 (Research Triangle Park, North Carolina, 1976).

The procedure for obtaining counselor, student and parent samples was carried out by CSSE project personnel. From Research Triangle Institute's sample of high school principals (n=37), thirty-five schools were selected at random. The principals of these schools were telephoned to obtain the names of the counselors and to request their participation in the survey. One counselor was called from each school and asked to assist with the administration of questionnaires to one class of senior students and their parents for a small fee. Twenty-seven schools participated in this process. The counselor was instructed to select a representative class of seniors. Although the counselor was cautioned not to select a class of students that was in any way unique (i.e., science or math classes or classes that meet at a time when a large number of students are not in school), the actual class selection was delegated to the counselor. The student questionnaires were administered and collected during a class period. No attempt was made to obtain responses from students not present on that day.

Each student in the class selected by the counselor addressed a questionnaire packet to his or her parents. The questionnaire packets were then mailed to parents by the counselor. It was asked that only one parent complete the questionnaire. Each parent returned the survey directly to the University of Illinois and concurrently mailed a postcard to the counselor, thus providing the counselor with a mechanism to follow-up non-responding parents.

In addition to the 35 principals contacted by telephone, all other high school principals were asked by mail to send a list of the counselors at their school. From these and follow-up telephone responses, one counselor was selected at random from each school. For those remaining schools from which no counselor names were obtained, a questionnaire was mailed simply addressed to the "head counselor."

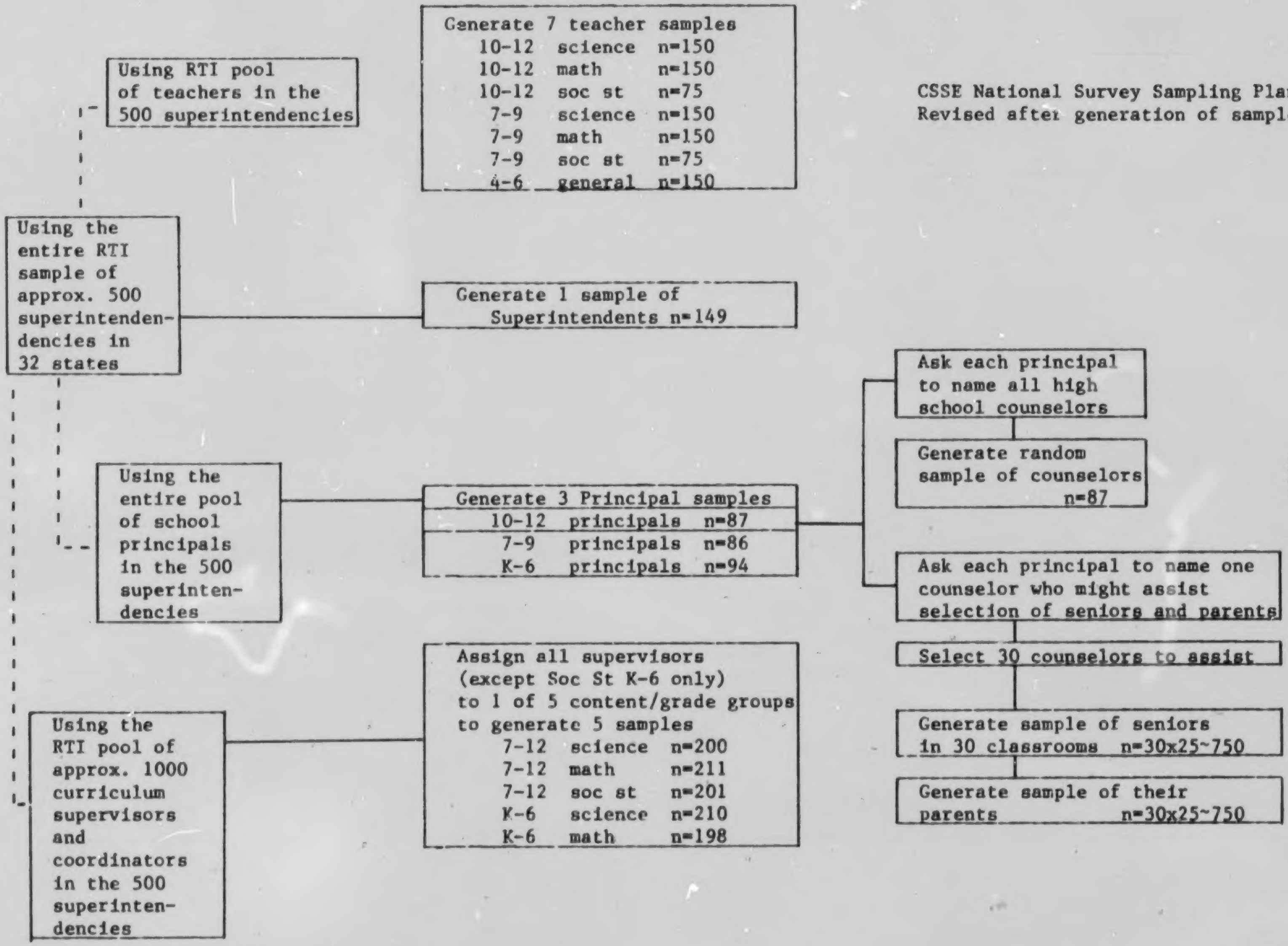
The initial mailing was carried out during the week of September 26, 1977, to superintendents, supervisors and principals. Teacher questionnaires were mailed the week of October 3 by Research Triangle Institute to preserve promised anonymity of this sample. Reminder postcards were sent to all samples the week of October 10, and a second copy of the questionnaire was mailed to all non-respondents during the week of October 17.

Packets of questionnaires for students and teachers were sent to counselors the weeks of September 26 through October 10. Counselor questionnaires were mailed during the last two weeks of October. Due to constraints of time, no follow-up effort was made on the counselor sample.

Each respondent, except students, received a questionnaire packet consisting of survey instrument, a one page summary of the purpose of the study and the survey, and a stamped, addressed, return envelope. Students questionnaires were handed out in class and returned to the counselor.

FIGURE 18-1: SCHEMATA OF SURVEY PLAN

CSSE National Survey Sampling Plan
Revised after generation of sample


Using RTI pool of teachers in the 500 superintendencies
Generate 7 teacher samples
10-12 science n=150
10-12 math n=150
10-12 soc st n=75
7-9 science n=150
7-9 math n=150
7-9 soc st n=75
4-6 general n=150
Using the entire RTI sample of approx. 500 superintendencies in 32 states
Generate 1 sample of Superintendents n=149
Using the entire pool of school principals in the 500 superintendencies
Generate 3 Principal samples
10-12 principals n=87
7-9 principals n=86
K-6 principals n=94
Ask each principal to name all high school counselors
Generate random sample of counselors n=87
Ask each principal to name one counselor who might assist selection of seniors and parents
Select 30 counselors to assist
Generate sample of seniors in 30 classrooms n=30x25~750
Generate sample of their parents n=30x25~750
Using the RTI pool of approx. 1000 curriculum supervisors and coordinators in the 500 superintendencies
Assign all supervisors (except Soc St K-6 only) to 1 of 5 content/grade groups to generate 5 samples
7-12 science n=200
7-12 math n=211
7-12 soc st n=201
K-6 science n=210
K-6 math n=198

Response Rates. The table below describes the eight scenarios and the samples to which each was administered. In addition, the sample sizes and response rates are indicated for each group.

DESCRIPTION OF SCENARIOS & SURVEY RESPONSE RATES

Scenario Content	Respondent Groups	Sample Size Mailing	Sample Size Response	Response Rates in Percent
S: Budget cuts and their ramifications	Superintendents	149	74	50
	Sci Supervisors (7-12)	200	139	70
	Parents	~250	111	~44
T: Issues of pluralism and uniformity	Sci Supervisors (K-6)	210	134	64
	Principals (10-12)	87	54	62
	Parents	~250	142	~57
U: The back-to-the-basics movement	Soc Studies Sup (7-12)	201	153	76
	Principals (K-6)	94	59	63
	Math Teachers (10-12)	150	94	63
V: Problems that arise in diagnostic teaching	Math Supervisors (K-6)	198	116	59
	Math Teachers (7-9)	150	81	54
W: Teaching and socialization	Principals (7-9)	86	47	52
	Teachers (K-6)	150	78	55
X: Support systems available to teachers	Math Supervisors (7-12)	211	132	63
	Science Teachers (7-9)	150	93	62
Y: Personal bias in teaching	Soc Studies Teachers (7-9)	75	42	56
	Soc Studies Teachers (10-12)	75	41	55
	Senior students	361	361	100
	Parents	~250	148	~59
Z: Elitism in the sciences	Counselors (10-12)	87	46	53
	Science Teachers (10-12)	150	101	67
	Senior students	375	375	100

Twenty-two distinct questionnaires were prepared for the groups listed above. In addition, three different fourth pages of questions were printed on the instruments for each group, resulting in 66 distinct instruments.

It was hoped that response rates would approach 70 percent in order to provide samples of approximately 100 respondents for superintendents, supervisors and all teachers except social studies. For social studies teachers, principals and counselors, a return of approximately 50 was anticipated. Response rates ranged from 50 percent for superintendents to 76 percent for social studies supervisors of grades 7 through 12, although one sample of parents is estimated to have a 44 percent rate. Parent response rates were computed on the basis of the number of student responses. Response rates of 100 percent are presented for students due to the nature of the questionnaire administration to this group. Ignoring parent and student returns, the median response rate was 62 percent.

Data Analysis. Data from questionnaires were transferred to optical scanning sheets. All questionnaire items having response options were given numerical codes to facilitate computer analysis. Most of the open-ended questions were analyzed by hand and, as a result, are reported only with raw frequencies of responses. The optical scanning sheets were read onto punched cards that were used to create data files on computer disk. Data were analyzed using the standard programs in the Statistical Package for the Social Sciences.* Each analysis was performed twice, first to calculate unweighted frequencies and percentages and again to calculate weighted percentages. The procedure for calculating the latter is discussed below.

Interpretation of Results. The question of whether to use weighted or unweighted percentages is in the interpretation of findings from a survey such as the present one is problematic. The decision of which procedure to use is perhaps best based upon the purpose of the interpretation. If stratified or cluster sampling has been used and differing sizes of cluster have been selected with probabilities proportionate to size, and if it is desirable to generalize to the original population, the use of weighted percentages is appropriate.** However, unweighted percentages may be justified if it is desirable to interpret the results simply as a proportion of persons responding to a given question.

The use of the Research Triangle Institute data base, after appropriate modification of their original sampling weights to incorporate the subsampling procedure, permits generalization of responses from the present survey to the national population for superintendents, principals, teachers and supervisors. This procedure assumes, however, that the opinion of each individual in the population carries equal weight. If it were thought that the opinion of one type of individual is more important than that of another type, for example, a superintendent of a large metropolitan district as compared to a superintendent of a small rural district, then the weighting scheme used in the present report is undesirable.

An additional problem arose in the calculation of weighted estimates for counselors, students and parents. In order for the weighted reponses to be consistent with those of the samples selected by Research Triangle Institute, an additional sampling weight should be required. In the case of students, for example, in addition to the weight of the high school selected, it would be necessary to estimate the number of senior students similar to those responding that each student represents. In the present study, counselors were asked to use their own judgment, following certain guidelines, in the selection of a class of students. Such an estimate would be subject to extreme errors, both of sampling and bias. The same would be true for parents, and perhaps to a lesser extent, for counselors. Thus it was decided to use as weights for these three groups only the school weight as provided by RTI as appropriately modified for subsampling.

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*Norman H. Nie, et al, Statistical Packages for the Social Sciences, 2d ed. (New York: McGraw-Hill, 1975).

**Seymour Sudman, Applied Sampling (New York: Academic Press, 1976).

The present report should present both weighted and unweighted percentages for all groups in order to be complete. Space constraints of including each question and answers of all respondent groups in the body of the text preclude this approach. Thus, results for superintendents, principals, teachers and supervisors are presented with both the raw frequency tabulations and only the modified weighted percentages. For these 16 groups, the weighted percentages may be used, with usual caveats, to generalize to the national population. For the remaining response groups, counselors, parents and students, raw frequency tabulations are accompanied by both weighted and unweighted percentages. The unweighted figures are in parentheses directly following the weighted ones. The discussion of findings has concentrated on the weighted percentages in all cases, but the reader of this report is cautioned to examine both percentages and to form generalizations accordingly.

In order to facilitate the calculations of standard errors for various proportions and sample sizes, Research Triangle Institute provided a formula for calculation of standard errors based upon some assumptions regarding the design effect (DEFF) of the samples. The formula is as follows.

$$SE = \sqrt{\frac{DEFF\ p(1-p)}{n}}$$

Where p is the proportion responding to a given answer, n is the sample size, and the design effect is estimated as 2.472 for all samples except students and parents samples for which a design effect value of 10 was recommended by Research Triangle Institute.

Tables 18-1 and 18-2 contain standard errors for various proportions and sample sizes. Table 18-1 should be used to estimate standard errors for superintendents, principals, teachers, supervisors and counselors. The standard errors in Table 18-2 are for use with students and parents. For sample sizes and p-values not represented in the table it is suggested that the next smaller sample size and the next large p-value be used. This will provide a more conservative estimate. Alternately, the above formula may be used to calculate an estimated standard error.

Throughout the discussion of the results, few statements are made regarding a significant statistical difference in the responses. The standard errors may be used to test for significant differences if this degree of specificity is desired. The traditional formula for this procedure is discussed by Snedecor and Cochran.*

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*George W. Snedecor and William G. Cochran, Statistical Methods, 6th ed. (Ames, Iowa: Iowa State University Press, 1967), pp. 219-221.

TABLE 18-1

Approximate Standard Errors in Percents(1)

Sample Size	P-values - %									
n	5 or 95	10 or 90	15 or 85	20 or 80	25 of 75	30 or 70	35 or 65	40 or 60	45 or 55	50
30	6.3	8.6	10.3	11.5	12.4	13.2	13.7	14.1	14.3	14.4
40	5.4	7.5	8.9	9.9	10.8	11.4	11.9	12.2	12.4	12.4
50	4.8	6.7	7.9	8.9	9.6	10.2	10.6	10.9	11.1	11.1
60	4.4	6.1	7.2	8.2	8.8	9.3	9.7	9.9	10.1	10.1
70	4.1	5.6	6.7	7.5	8.1	8.6	9.0	9.2	9.3	9.4
80	3.8	5.3	6.3	7.0	7.6	8.1	8.4	8.6	8.7	8.8
90	3.6	5.0	5.9	6.6	7.2	7.6	7.9	8.1	8.2	8.3
100	3.4	4.7	5.6	6.3	6.8	7.2	7.5	7.7	7.8	7.9
110	3.3	4.5	5.4	6.0	6.5	6.9	7.2	7.3	7.5	7.5
120	3.1	4.3	5.1	5.7	6.2	6.6	6.8	7.0	7.1	7.2
130	3.0	4.1	4.9	5.5	6.0	6.3	6.6	6.8	6.9	6.9
140	2.9	4.0	4.7	5.3	5.8	6.1	6.3	6.5	6.6	6.6
150	2.8	3.9	4.6	5.1	5.6	5.9	6.1	6.3	6.4	6.4
200	2.4	3.3	4.0	4.5	4.8	5.1	5.3	5.5	5.5	5.6
150	2.2	3.0	3.6	4.0	4.3	4.6	4.7	4.9	5.0	5.0
300	2.0	2.7	3.2	3.6	3.9	4.2	4.3	4.5	4.5	4.5
350	1.8	2.5	3.0	3.4	3.6	3.9	4.0	4.1	4.2	4.2
400	1.7	2.4	2.8	3.1	3.4	3.6	3.8	3.9	3.9	3.9
450	1.6	2.2	2.7	3.0	3.2	3.4	3.5	3.6	3.7	3.7
500	1.5	2.1	2.5	2.8	3.0	3.2	3.4	3.4	3.5	3.5

$SE = \sqrt{\frac{DEFF\ p(1-p)}{n}}$ assuming DEFF = 2.472

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(1)To be used with Superintendents, Supervisors, Principals, Counselors and Teachers

TABLE 18-2

Approximate Standard Errors in Percents(1)

Sample Size	P-values - %									
n	5 or 95	10 or 90	15 or 85	20 or 80	25 or 75	30 or 70	35 or 65	40 or 60	45 or 55	50
100	6.9	9.5	11.3	12.7	13.7	14.5	15.1	15.5	15.7	15.8
110	6.6	9.1	10.8	12.1	13.1	13.8	14.4	14.8	15.0	15.1
120	6.3	8.7	10.3	11.6	12.5	13.2	13.8	14.1	14.4	14.4
130	6.0	8.3	9.9	11.1	12.0	12.7	13.2	13.6	13.8	13.9
140	5.8	8.0	9.5	10.7	11.6	12.3	12.8	13.1	13.3	13.4
150	5.6	7.8	9.2	10.3	11.2	11.8	12.3	12.7	12.9	12.9
350	3.7	5.1	6.0	6.8	7.3	7.8	8.1	8.3	8.4	8.5
360	3.6	5.0	6.0	6.7	7.2	7.6	8.0	8.2	8.3	8.3
370	3.6	4.9	5.9	6.6	7.1	7.5	7.8	8.1	8.2	8.2
380	3.5	4.9	5.8	6.5	7.0	7.4	7.7	8.0	8.1	8.1
390	3.5	4.8	5.7	6.4	6.9	7.3	7.6	7.8	8.0	8.0
400	3.5	4.7	5.7	6.3	6.9	7.3	7.5	7.8	7.9	7.9
700	2.6	3.6	4.3	4.8	5.2	5.5	5.7	5.9	6.0	6.0
710	2.6	3.6	4.2	4.8	5.1	5.4	5.7	5.8	5.9	5.9
720	2.6	3.5	4.2	4.7	5.1	5.4	5.6	5.8	5.9	5.9
730	2.6	3.5	4.2	4.7	5.1	5.4	5.6	5.7	5.8	5.9
740	2.5	3.5	4.2	4.7	5.0	5.3	5.5	5.7	5.8	5.8

$SE=\sqrt{\frac{DEFF\ p(1-p)}{n}}$ assuming DEFF = 10.0

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(1) To be used with parents and students

Comments. An undertaking of the magnitude of the survey summarized in the present chapter almost inevitably entails difficulties in design, administration and/or reporting. The Case Studies in Science Education Survey had its share of problems and the major difficulties, while many are also discussed elsewhere in the report, are summarized below.

As described previously, each of the scenarios on pages 2 and 3 of the questionnaire was designed to acquaint the respondents with an important issue in science education and then to pose a number of questions about that issue. While the entire questionnaire was motivated by the experiences of the case study field observers, it was hoped that the scenarios especially would capture the essence of those experiences. A major difficulty occurred, however, with the attempt to represent complex local conditions, using a contrived setting, in survey language. It was planned that the scenario format would orient the respondents to the general issue with enough specific information to increase the relevance of the questions to their own situations and to provide project personnel with a framework within which to interpret their responses. It was found, however, that respondents often reacted to the details portrayed in the scenarios instead of the underlying issues.

The description of the questionnaire provided above indicates the complexity of the survey design. The twenty-two samples, each with three distinct Page 4 formats, resulted in sixty-six different instruments. The printing layout, record keeping and analysis became very complex. Yet there were many groups whose opinions were important to assess and there were many questions to ask with only a limited amount of space on any one questionnaire. The result of this design was that a great deal of information was obtained, much of it based upon small sample sizes. The larger standard errors accompanying small samples present a problem to readers who wish to generalize beyond the present sample with any considerable precision.

Despite follow-up post cards and a second mailing of the questionnaire to non-respondents, the overall proportion of persons returning the questionnaire was only slightly greater than 60 percent; it had been hoped that a response rate approaching 70 percent would be achieved. An obvious component of the problem, but an unavoidable one, was that the mailing addresses of respondents in the samples selected by Research Triangle Institute were from the school year preceding the one in which the present survey was completed. It would be advisable to investigate non-respondent bias by following-up a sample of these persons and comparing them to the respondents on several basic criteria. This type of follow-up was not done in the present project, partially due to constraints of time in completing the survey for the final report.

Another consequence of time constraints was the concentration on simple tabular analyses of responses from each sample in the final report. The findings summarized herein really result only from first order analyses; many other divisions of the data are possible and might well provide additional insights into the different ways people feel about issues in science education. In addition to the obvious breakdowns by geographic location and size of school district, it might be instructive to compare opinions of less experienced with more experienced personnel, of those who have and have not participated in NSF Institutes, of administrative and teaching personnel, or of those who disagree on the basic goals of education. Additionally, the possibility exists for exploration of group similarities or common dimensions of opinion using multivariate methods. The survey has resulted in a wealth of information; it would be regretable not to examine the data in greater detail than is done in the present chapter.

Despite the difficulties cited, the survey was not unsuccessful in its attempt to corroborate case study findings. Some of the major case study results are referred to in the context of the survey discussion; assimilation and overview chapters of this report further highlight the integration of these two phases of the study. The survey was only one portion of the project with a budget of less than ten percent of the cost of the entire study. It was meant to supplement and extend - not to provide a summary of the findings of the entire project. It was designed to assess the generalizability of the major case study results -- and, in general, accomplished these objectives. As the survey responses are examined, the reader is repeatedly reminded of a case study finding. The results especially indicate an overall confirmation of the importance of the science education issues identified in the eleven case study sites - and should provide those interested in science education with new insights into these issues.

RESPONSES TO DEMOGRAPHIC AND EXPERIENCE-RELATED QUESTIONS

The first page of each questionnaire was primarily devoted to demographic, biographic and experience-related questions. Each group received a personalized questionnaire front page that asked questions about their experience and educational activities. One or two questions of a more general nature regarding science education were also included in the space following the demographic and biographic questions. The results of the responses to the general questions are summarized immediately following analysis of the demographic and experience-related questions. In the following analyses, as throughout the present chapter, raw frequencies and weighted percents are given for all groups except students, parents and counselors in which cases unweighted percents are also reported in parentheses following the weighted percents. The percentages are based upon those who answered the question, not upon the entire sample. Approximate standard errors may be found in Tables 18-1 and 18-2.

All respondents were asked to describe their school districts in terms of size and geographic relationship to larger cities. They were also requested to indicate the manner in which grades are commonly divided into schools in their district. Unfortunately, a large number (23%) of respondents neglected to record answers to them. In addition, the coding of the second question did not permit easy computer calculation. Consequently, the results presented here pertain only to the geographic description of the district and the reader is cautioned to keep in mind the high proportion of missing data.

Approximately half of our respondents, according to raw frequencies, reported that their districts are located in rural or small cities/towns (see results on following two pages). The weighted percentages indicate that approximately 60 to 70 percent are from this type of school district. The sampling weights provided by Research Triangle Institute were based on a multi-stage cluster design that included stratification on geographic area and subsequent sampling of school districts with probability proportional to total district enrollment. These weights were calculated by Research Triangle Institute on the basis of actual probabilities with which each respondent (except students, parents and counselors) entered the sample.* As a consequence of the sampling procedure, respondents from smaller areas may represent more subjects similar to themselves than do respondents from larger areas. Using raw frequencies, approximately 10 percent of our sample indicated they are from cities over 500,000 or suburbs of such cities. The weighted percentages are approximately the same as the raw frequencies for this combined geographic division.

Questions for Superintendents. Superintendents were asked to note the number of years they have been superintendents. Fifteen percent reported that this is their first year in a superintendency and 35 percent stated they have been in this position more than 11 years. The weighted average is 9.5 years. Sixty-eight (96%) reported they taught a weighted average of 5.8 years before becoming

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*Research Triangle Institute, A Proposal for Survey of Materials Usage in Pre-College Education in the U.S.: RFP 76-108 (Research Triangle, North Carolina, 1976).

TABLE 18-3

Which of the following best describes the location of your district?

	Superintendents		Supervisors										Principals						Counselors		
			K-6 Science		K-6 Math		7-12 Science		7-12 Math		7-12 Soc Stud		K-6		7-9		10-12				
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Rural or farming community	12	74	30	59	25	67	19	53	18	44	24	66	12	29	10	49	10	41	10	27	(28)
Small city or town (up to 50,000)	9	17	24	28	19	18	23	31	23	26	16	15	12	25	11	31	8	31	7	41	(19)
Medium-sized city (50,000-100,000)	2	2	5	2	5	3	12	4	7	2	12	2	4	4	1	0	2	3	1	1	(3)
Suburb of a medium-sized city	2	4	4	5	4	1	0	0	6	22	4	1	3	5	2	6	3	2	4	4	(11)
Large city (100,000 to 500,000)	4	1	7	1	9	6	14	2	16	2	13	1	1	1	2	2	4	3	4	2	(11)
Suburb of large city	3	1	6	1	8	3	11	4	4	1	13	3	7	17	7	9	5	3	5	5	(14)
Very large city (over 500,000)	1	0	8	1	8	1	8	0	9	1	4	0	2	4	2	2	2	13	2	16	(6)
Suburb of a very large city	5	1	9	3	2	1	12	3	7	3	12	8	2	9	0	0	3	1	2	3	(6)
Other/more than 1	1	0	3	2	8	0	7	4	2	0	8	4	3	7	1	1	4	3	1	1	(3)
Omissions	35	-	38	-	28	-	33	-	40	-	47	-	13	-	11	-	13	-	10	-	-
Total Sampling Size	74		134		116		139		132		153		59		47		54		46		

TABLE 18-3, Continued

	Teachers																			
	Elem K-6		Science 7-9		Math 7-9		Soc Stud 7-9		Science 10-12		Math 10-12		Soc Stud 10-12		Seniors			Parents		
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%		n	%	
Rural or farming community	13	27	16	36	16	26	12	34	14	17	12	12	10	41	132	26	(21)	80	29	(26)
Small city or town (up to 50,000)	23	34	14	21	12	37	8	31	21	28	24	45	5	15	178	45	(28)	68	27	(22)
Medium-sized city (50,000-100,000)	2	2	6	7	10	7	1	5	8	5	7	5	4	8	43	6	(7)	31	18	(10)
Suburb of a medium-sized city	1	1	2	2	1	1	1	1	1	13	2	1	3	7	73	7	(12)	22	4	(8)
Large city (100,000 to 500,000)	4	11	6	6	8	10	4	9	7	4	4	2	1	4	68	6	(11)	28	3	(9)
Suburb of a large city	8	11	7	7	6	3	7	15	9	18	7	20	3	8	71	4	(11)	25	3	(8)
Very large city (over 500,000)	3	6	3	1	2	1	0	0	3	4	8	9	0	0	23	2	(4)	7	1	(2)
Suburb of a very large city	4	5	11	19	1	5	0	0	7	11	6	5	2	15	43	4	(7)	41	15	(13)
More than one/ other	2	3	1	1	1	1	2	4	1	0	3	2	1	2	2	0	(0)	3	0	(1)
Omissions	18	-	27	-	24	-	7	-	30	-	21	-	12	-	103	-	-	96	-	-
Total Sampling Size	78		93		81		42		101		94		41		736			401		

superintendents. Superintendents were asked to estimate the current student enrollment in their districts, the number of fulltime teachers and the per-pupil expenditure in 1976-77 (including all annual operating expenses but not capital outlay). The enrollment figures reported indicate that our superintendents came from districts widely varying in size. Accordingly, the number of fulltime teachers is also spread over a large range. Raw frequency modal intervals are a district with 5,000 to 10,000 students and 200 to 400 teachers; weighted averages are 4623 and 273 respectively. Seventy-five percent of the superintendents indicated that per-pupil expenditures range between 1000 and 1500 dollars yearly. The weighted average is $1250 per pupil

What is the current approximate student enrollment in your district?

Superintendents

Enrollment	n	%
500 or less	8	20
501 to 1,000	7	24
1,001 to 2,500	5	14
2,501 to 5,000	8	18
5,001 to 10,000	18	14
10,001 to 20,000	9	6
20,001 to 50,000	10	3
More than 50,000	8	1

The weighted average enrollment in the 73 districts reporting is 4,624 students.

How many fulltime equivalent teachers are there in your district?

Superintendents

Number of Teachers	n	%
20 or less	6	10
21 to 100	9	33
101 to 200	6	10
201 to 400	14	22
401 to 600	9	18
601 to 1,000	7	3
1,001 to 2,000	7	3
More than 2,000	9	1

The weighted average number of teachers is 273 in the 67 districts reporting on this item.

What was the average per-pupil expenditure in your district in 1976-77 school year? (Please include all annual operating expenses but not capital outlay.)

Superintendents

Expenditures	n	%
500 or below	5	2
501 to 1,000	9	17
1,001 to 1,100	11	10
1,101 to 1,200	14	25
1,201 to 1,300	5	7
1,301 to 1,400	9	6
1,401 to 1,500	9	27
More than 1500	4	7

The weighted average annual expenditure in the 66 districts reporting on this item is $1250 per pupil.

Questions for Supervisors. Supervisors were asked to indicate their official titles. Approximately 16 percent of the secondary school supervisors reported they are department heads or chairpersons. Twelve to 18 percent of all groups said they are called supervisors or coordinators but approximately 20 percent are teachers. Other titles included assistant principal, principal, consultant, specialist, assistant superintendent, superintendent, and various director or administrator titles of areas such as curriculum and/or instruction, education, science, mathematics or social studies.

The wide diversity of titles and percentages devoted to supervisory activities reported below indicate that the title "supervisor" as used in the present study is somewhat ambiguous. Indeed, frequently this person is a teacher or administrator with only minimal responsibility for supervising activities. This is a result of the original RTI sampling procedure in which the target population of supervisors was constructed. Many districts do not have "curriculum supervisors" and thus the person most knowledgeable about the curriculum was so denoted for purposes of the RTI survey.*

Supervisors

What is your primary assignment?	K-6 Sci		K-6 Math		7-12 Sci		7-12 Math		7-12 Soc Stud	
	n	%	n	%	n	%	n	%	n	%
Curriculum Supervising	67	38	59	25	33	4	34	14	50	16
General Administration	31	22	25	42	11	13	16	17	17	13
Teaching	27	31	20	29	35	29	41	39	28	25
Department Head	1	0	1	3	8	36	4	0	10	8
Other	5	10	5	2	50	18	35	30	46	39

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*Research Triangle Institute, A Proposal for Survey of Materials Usage in Pre-College Education in the U.S.: RFP 76-108 (Research Triangle, North Carolina, 1976).

What percent of fulltime employment do you devote to curriculum supervising, coordination, consultation with teachers on instruction and similar matters?

Supervisors

	K-6 Sci		K-6 Math		7-12 Sci		7-12 Math		7-12 Soc Stud	
	n	%	n	%	n	%	n	%	n	%
10% or less	28	22	18	26	26	56	30	30	34	32
11% to 25%	12	17	16	37	21	13	20	13	19	26
26% to 50%	24	18	21	16	19	9	19	14	14	14
51% to 75%	22	19	16	11	13	4	11	12	19	7
76% to 90%	15	4	14	7	13	2	10	2	29	17
91% or more	26	20	22	3	18	5	32	28	21	4

When asked to indicate their primary assignment, 38 and 25 percent respectively of elementary science and mathematics supervisors said that it is curriculum supervision. Smaller proportions of the secondary supervisors indicated this assignment. Varying proportions from 13 percent of the secondary social studies supervisors to 42 percent of the elementary math supervisors stated they are primarily assigned to general administration. Approximately 30 percent of all groups reported that they are assigned as teachers and 36 percent of secondary science supervisors are department heads.

The supervisors reported that they devote widely varying amounts of time supervising and coordinating activities. A majority of all groups devote 50 percent or less of their time to this endeavor. Weighted averages of the amount of time spent on supervising activities by the five groups in order of listing in the above table are: 54%, 32%, 22%, 48%, and 38%.

Do you supervise curricular matters in areas other than (science, math, social studies)?

Supervisors

	K-6 Sci		K-6 Math		7-12 Sci		7-12 Math		7-12 Soc Stud	
	n	%	n	%	n	%	n	%	n	%
Yes	86	67	65	79	47	65	53	59	64	55
No	44	34	45	21	86	35	75	41	82	45

Almost two-thirds reported that they supervise areas other than just the one for which they are reporting. Thus any comparisons between groups must be made with the reminder that each group, in reality, represents a mixture of school personnel with varying duties and discipline orientations.

Elementary supervisors in this sample stated that they provide consultation and aid to a slightly larger number of teachers than do secondary supervisors.

The two elementary groups reported they are responsible for a weighted average of 110 and 105 teachers respectively. Secondary science supervisors interact with the lowest number of teachers, a weighted average of 60, while secondary mathematics and social studies supervisors reported figures of 93 and 97 respectively.

This group appears to be quite experienced in working with teachers with science and mathematics personnel reporting weighted averages between 7 and 9 years of supervising activity. Secondary social studies supervisors have served in this capacity for an average of slightly over 5 years. Before assuming curriculum supervisory responsibilities over 65 percent of the elementary supervisors and the secondary social studies supervisors were engaged in teaching. Approximately 45 percent of the secondary science and mathematics teachers taught previously, and they were more inclined to have taught in their own disciplines. The weighted average number of years for those who taught is quite similar for all groups, ranging from 9.9 to 11.8 years.

Finally, the supervisors were asked whether or not they had attended National Science Foundation institutes, either in the summer or during the academic year. Only about a third reported such activity except for secondary science supervisors, of whom over 60 percent reported participation in NSF institutes. Of those who have attended NSF institutes, the weighted average number attended ranged from 1.6 for social studies supervisors, approximately 2.3 for both groups of elementary supervisors and those responsible for secondary mathematics, to 3.5 institutes per person for secondary science supervisors. It is quite possible that the NSF institutes are viewed by this group as primarily directed toward science teaching and supervising in secondary schools. The fact that a majority of our supervisors reported that they are responsible for areas other than just the one for which they were selected may also account for the lower attendance figures reported by the other groups.

Questions for Principals. Principals of schools with grades 7 through 9 were asked whether their schools were considered middle-schools or junior high schools and 77 percent reported the latter. Over half of all respondents stated they have been principals for 6 or more years; this proportion is larger than 80 percent for the junior high group. The weighted average number of years as principal was reported as 8.8, 11.5 and 5.5 for elementary, junior high and senior high schools, respectively. Most of the junior high group had previously served as principals of schools with other grade levels with 10 percent having been high school principals and 71 percent having been elementary principals. Before becoming principals, they had taught for a weighted average of 10.9, 16.2 and 8.5 years, respectively. Fourteen percent of junior high principals previously taught science as did 36 percent of the high school principals. Figures for previous mathematics teaching for these two groups were 12 percent and 43 percent, respectively.

Average student enrollment was reported as 392 in elementary schools, 582 in middle or junior high schools and 757 in high schools. The weighted average numbers of fulltime teachers were recorded as approximately 18, 27 and 37 respectively. However, there was a wide range of this variable. Only 8 percent of elementary principals said there are more than 30 teachers in their school while 13 percent of junior high and 23 percent of high school principals reported more than 50 teachers.

What was the per-pupil expenditure in your district in the 1976-77 school year?

Principals

	Elementary		7-9		10-12	
	n	%	n	%	n	%
500 and below	8	16	3	37	1	3
501 to 1000	6	13	5	17	8	56
1001 to 1100	7	24	4	15	7	12
1101 to 1200	1	13	3	8	6	3
1201 to 1300	2	3	4	4	3	3
1301 to 1400	1	2	2	4	3	6
1401 to 1500	0	0	1	5	5	8
More than 1500	7	30	3	11	5	10

The weighted average per-pupil expenditures are $1155, $936 and $1082 as reported by the principals answering this item and are somewhat smaller in magnitude than that reported by superintendents.

Questions for Teachers. Seven groups of teachers were included in the survey: elementary teachers; science, mathematics and social studies teachers of grades 7 through 9; science, mathematics and social studies teachers of grades 10 through 12.

How many years have you been a teacher?

Teachers

	K-6		7-9 Science		7-9 Math		7-9 Soc Stud		10-12 Science		10-12 Math		10-12 Soc Stud	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
# of yrs.														
5 or less	17	26	24	20	25	25	9	23	13	18	21	14	6	15
6 to 10	24	30	28	42	18	21	13	32	37	36	27	53	18	51
11 or more	36	44	41	38	38	54	20	34	51	46	45	34	16	34
Wt. avg. # of yrs taught	11.4		11.2		12.7		10.0		11.1		10.2		9.9	
Wt. avg. # of yrs taught in specific discipline	N.A.		10.2		11.2		8.1		10.7		9.7		8.6	

The teachers responding to our survey are quite experienced, averaging over 10 years of teaching. Elementary teachers were asked the grade level they are currently teaching. Thirty (28%) teach kindergarten through second grade; 30 (20%) teach third or fourth grade; and 39 (47%) reported teaching fifth or sixth grade. The teachers of specific disciplines (science, mathematics and social studies) were asked how many years they had been teaching courses in their respective areas. The distribution of responses was quite similar to that for the number of years teaching in general as is evident from comparison of the average number of years taught and the average number taught in a specific discipline in the preceeding table.

Teachers in junior high and high schools were asked the number of courses that usually constitute a fulltime teaching load at their school. The majority of all groups indicated 5 to 6 courses; there is a very slight tendency for a lighter course load in grades 10 through 12 as evidenced by the slightly smaller averages for this group.

What is the usual number of courses for a fulltime teaching load at your school?

Teachers

	7-9 Science		7-9 Math		7-9 Soc Stud		10-12 Science		10-12 Math		10-12 Soc Stud	
	n	%	n	%	n	%	n	%	n	%	n	%
4 or less	30	38	15	29	9	35	27	39	24	34	10	22
5 to 6	51	57	56	66	28	59	63	59	66	66	28	78
7 or more	3	5	2	5	3	6	2	2	1	1	0	0
Wt. avg.	4.6		4.9		4.9		4.6		4.2		4.6	

Courses currently being taught by science teachers:

Course	7-9 Teachers		10-12 Teachers	
	n	%	n	%
General Science	37	35	5	4
Biology	15	13	58	50
Botany	0	0	4	2
Physics	7	10	18	25
Chemistry	5	7	26	25
Ecology	2	1	1	1
Math	4	3	5	5
Social Studies	1	1	0	0
Other	57	58	59	62

When asked to indicate the courses they were teaching during the Fall of 1977, general science was the most commonly taught course of those listed by science teachers of grades 7 through 9. It should be noted that the physics and chemistry courses listed by this group may be being taught by those who teach in schools having grades 10 through 12 in addition to grades 7 through 9. Exactly 50 percent of the high school science teachers were teaching biology courses. Physics and chemistry were each being taught by approximately one-fourth of this respondent group.

Courses currently being taught by mathematics teachers:

Course	7-9 Teacher		10-12 Teacher	
	n	%	n	%
General Math	42	51	39	45
Algebra	28	41	71	66
Geometry	10	20	44	63
Calculus	2	8	15	6
Remedial Math	0	0	3	2
Business Math	0	0	10	5
Advanced Math	0	0	12	12
Science	2	3	10	10
Social Science	1	3	0	0
Other	30	42	24	13

The course taught most frequently by mathematics teachers in grades 7 through 9 was reported to be general math, although algebra was indicated by over 40 percent of these teachers and geometry by 20 percent. These latter two courses were the ones taught by the largest proportion, over 60 percent, of mathematics teachers in grades 10 through 12. There were no teachers in grades 7 through 9 who reported teaching remedial or business mathematics and the incidence of these courses in high school was quite small.

Courses currently being taught by social studies teachers:

Course	7-9 Teacher		10-12 Teacher	
	n	%	n	%
American Govt/Civics	4	6	1	1
American History	14	40	21	51
Other history	3	23	14	42
Sociology	4	8	3	7
Psychology	1	2	5	11
Religion	0	0	0	0
Economics	2	3	1	2
Math	2	5	1	1
Science	3	6	1	9
Other	26	77	16	37

American history is the course most often taught by social studies teachers in both junior high and high schools. These teachers reported spending the majority of their time teaching history courses with only small proportions teaching in other social studies areas such as sociology, psychology and economics. No teacher reported teaching a course in religion during the present semester.

We asked all except the elementary teachers to tell us about their participation in science fairs and mathematics or science clubs. Almost 50 percent of science teachers report sponsoring such activities; approximately one-fourth of the mathematics teachers have also been sponsors of fairs or clubs. As expected, social studies teachers reported almost no activity in this area.

Have you ever been a sponsor for a science fair or science club or math club?

Teaching sample		Responding yes	
		n	%
Science:	grades 7-9	49	47
	grades 10-12	54	48
Mathematics:	grades 7-9	17	25
	grades 10-12	31	31
Social Studies:	grades 7-9	4	7
	grades 10-12	0	0

> *"Rather than funding projects in curriculum reform, congress has stressed inservice programs to help teachers who are already in the schools. Administrators at NSF, such as Buccino and Hannabel, say they believe these inservice programs are the key to improving mathematics education. But some curriculum developers, such as Wilson and Fey, remark that this is a very political response. They point out that the NSF did not request funds for inservice programs in its current budget."**

All the teachers were asked about their participation in National Science Foundation institutes, both summer and academic year, and inservice courses. The proportion participating in NSF institutes has been about equal for teachers of given disciplines regardless of grade level taught. Approximately 40 percent of science teachers, 30 percent of mathematics teachers and only 10 percent of social studies teachers report having attended these institutes. The weighted average number varied from 1.3 institutes for social studies teachers (grades 7-9) and science teachers (grades 10-12) to 3.2 institutes for mathematics teachers of both grade ranges. Larger proportions reported participation in inservice and pre-service courses. Close to 50 percent of all groups indicated participation with over 70 percent of social studies teachers of grades 7 through 9 say-

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*Gina Bari Kolata, "Aftermath of the New Math: Its Originators Defend It," **Science**, 4 March 1977, pp. 854-857.

ing they have attended. The weighted average number of courses tends to be slightly higher for elementary and high school teachers, except for the high school mathematics teachers who reported the lowest average among all groups, 3.4. Thus, there is clear evidence that a substantial number of teachers, especially those in mathematics, have taken advantage of the NSF institutes. Even larger numbers reported continuing to upgrade their skills through attending inservice and pre-service courses. It is interesting to note that high school science teachers have the lowest average of NSF institutes attended and the highest average of inservice and pre-service courses. The situation is exactly reversed for high school mathematics teachers. It is regretable that reasons for this pattern of workshop participation were not investigated in the survey.

Participation in NSF institutes:

Teacher sample	Responding yes		Average number of institutes (weighted)
	n	%	
Elementary			1.7
Science: grades 7-9	39	41	3.0
Mathematics: grades 7-9	24	31	3.2
Social studies: grades 7-9	7	12	1.3
Science: grades 10-12	52	46	1.3
Mathematics: grades 10-12	38	31	3.2
Social studies: grades 10-12	4	10	2.5

Participation in inservice and pre-service courses in the last three years:

Teacher sample	Responding yes		Average number of institutes (weighted)
	n	%	
Elementary			8.2
Science: grades 7-9	42	48	5.3
Mathematics: grades 7-9	42	46	4.8
Social studies: grades 7-9	26	73	7.0
Science: grades 10-12	50	49	10.3
Mathematics: grades 10-12	44	53	3.4
Social studies: grades 10-12	20	42	9.2

Finally, we asked the teachers about their reading activities. Over 60 percent of all groups indicated that they read professional books and articles. Interestingly, the proportion was highest, 92 percent, for the elementary teachers. The average number of articles and books read varies considerably from one group to another with no clear pattern. Elementary, 7 through 9 mathematics, and 10-12 social studies teachers reported they read the largest number of general education articles. Elementary and 10 through 12 social studies teachers also read the largest number of general education books. In specific discipline areas, science teachers of all grades and social studies teachers of grades 10 through 12 reported the greatest reading activity.

Do you read the professional literature?

Teachers

	K-6		7-9 Science		7-9 Math		7-9 Soc Stud		10-12 Science		10-12 Math		10-12 Soc Stud	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Yes	70	92	71	63	55	64	31	83	85	78	63	70	32	76
Wt. avg. number of educ. articles read each month	10.9		5.5		7.8		3.1		2.4		5.4		7.5	
Wt. avg. number of discipline-specific (science, math, social studies) articles read			12.1		4.7		1.1		8.4		4.1		7.7	
Wt. avg. number of educ. books read each year	9.2		5.1		3.2		2.9		0.8		2.0		6.3	
Wt. avg. number of discipline-specific (science, math, social science) books read each year			4.4		2.0		1.0		3.5		2.0		8.2	

Questions for Counselors. A small group of counselors was included in our survey. A counselor from each high school from the sample of principals of grades 10 through 12 was sent a questionnaire. They reported having a weighted average of 6.5 years experience as counselors. Thirty were males and 41 stated that they held counseling certificates. The tables of counselor responses contain both weighted percentages and, in parentheses, unweighted percentages.

How many years have you been a counselor?

	Counselors	
Number of years	n	%
5 or less	7	54 (16)
6 to 10	21	23 (49)
11 or more	15	22 (35)

	Counselors	
Sex	n	%
Male	30	52 (65)
Female	16	48 (35)

Do you hold a counseling certificate?

	Counselors n	%
Yes	41	54 (93)
No	3	46 (7)

All of the 41 counselors who responded to the question indicated that they had taught before becoming counselors. They had taught a weighted average of 6.1 years. Approximately 10 percent indicated they had taught science or mathematics; 17 percent said they had taught social studies.

Area previously taught	Counselors n	%
Science	7	11 (17)
Mathematics	5	9 (13)
Social studies	12	17 (29)

Thirty-nine of the counselors indicated that they spend all of their time in counseling activities. Only two said they devote less than 50 percent of their time to counseling.

Finally, we asked counselors to indicate the areas in which they primarily work. Forty indicated academic counseling; vocational and personal counseling was checked by 30 and 35 counselors, respectively.

In what areas of counseling do you work mostly?

	Counselors n	%
Academic	40	53 (85)
Vocational	30	81 (64)
Personal	35	86 (74)
Therapeutic	3	5 (8)
Other	3	3 (8)

Questions for Students. Two questionnaires were developed for senior students but there were several identical questions on the first pages of both questionnaires. The combined sample size for the two groups of students was 736. The age and sex breakdown of the students indicates that 80 percent of the students are 17 years of age and they are almost equally distributed between males and females. Tables for students contain both weighted percentages and, in parentheses, unweighted percentages.

Age and Sex of Respondents

Age	Students n	Students %
16 or less	61	9 (8)
17	599	80 (82)
18 or more	72	11 (10)

Sex	Students n	Students %
Male	374	51 (51)
Female	355	49 (49)

The seniors were asked about their future plans and over 70 percent indicated that they anticipate being in college next year. Twenty-one percent said they will be working while approximately 5 percent were planning to attend vocational school.

What is your best guess as to what you will be doing in October and November of 1978?

	Students n	Students %
Working	148	20 (21)
Traveling	12	3 (2)
College	498	71 (71)
Vocational school	38	5 (5)
Nothing	10	1 (1)

We also asked seniors to check science, mathematics and social studies courses they had taken previous to their senior year. In the science area, over 80 percent had taken biology and 62 percent had general science. Chemistry had been taken by 45 percent of these students while only 10 percent took a course in either physics or ecology. In mathematics, the two most common courses were algebra (85%) and geometry (76%). Basic math was checked by approximately 45 percent of the students while 36 percent indicated coursework in advanced algebra. Almost all students, 93 percent, said they have had a course in American history. American government and economics were checked by 24 percent and 20 percent, respectively. Thirty-five percent indicated coursework in religion and approximately 10 percent had taken psychology or sociology.

Please check the courses you have completed in grades 9, 10, 11:

Course	Students n	Students %	Course	Students n	Students %
Biology	643	84 (87)	Adv. Algebra	279	36 (38)
Physics	75	10 (10)	American Govt.	246	24 (33)
Chemistry	336	51 (46)	American Hist.	689	93 (94)
Ecology	74	11 (10)	General Science	458	62 (62)
Algebra	650	85 (88)	Sociology	91	8 (12)
Geometry	544	76 (74)	Psychology	102	10 (14)
Basic Math	339	46 (46)	Religion	101	35 (14)
Calculus	14	3 (2)	Economics	169	20 (23)

Approximately half of the student sample (n=361) were questioned on their attitudes regarding the science, mathematics and social studies courses they had taken. Students were fairly evenly divided on their opinion of what is most right about science courses, especially on the options of being interesting, stressing basic facts, having good books and equipment and having small classes. Forty percent said that the thing most right about math is that the basic facts are stressed while almost 50 percent said that social studies courses are interesting. The proportion that selected the option "down to earth" is very small for each discipline, indicating either that they are not down to earth or that there are much more important characteristics to consider.

What is the one thing that is most right about the (Science, Math, Social Studies) courses you have taken?

	Science		Math		Social Studies	
	n	%	n	%	n	%
The courses were interesting	106	20 (31)	61	12 (18)	155	50 (46)
The courses were "down to earth"	23	6 (7)	18	9 (5)	39	8 (12)
They stressed the basic facts	91	22 (27)	120	40 (35)	93	28 (27)
They stressed fundamental ideas	63	14 (28)	106	19 (31)	37	7 (11)
Books & equip. were very good	38	19 (11)	30	7 (6)	11	2 (3)
Classes have been small	21	19 (6)	16	13 (5)	5	6 (2)

What is the one thing that is most wrong about the (Science, Math, Social Studies) courses you have taken?

	Science		Math		Social Studies	
	n	%	n	%	n	%
The courses were boring	84	29 (25)	100	31 (31)	84	27 (26)
The courses were impractical	18	7 (5)	33	12 (10)	22	9 (7)
Overemphasized facts and memorization	78	24 (23)	65	13 (20)	112	40 (35)
Too much aimed at the "bright" kids	43	7 (13)	77	26 (24)	13	2 (4)
Books & equip. were inadequate	43	15 (13)	21	5 (7)	40	11 (12)
Not enough lab & project work	70	19 (21)	22	14 (7)	53	10 (16)

When asked what is most wrong about their courses, approximately 30 percent of the seniors stated that courses in all three areas are boring. Both science (24%) and social studies (40%) were criticized for overemphasizing facts and memorization. It is mathematics that is most often considered as being aimed at the "bright" kids, this by 25 percent of the students. This criticism is much less frequently noted for science and rarely for social studies courses.

Questions for Parents. The total number of questionnaires received from parents was 401. As discussed in the methodology section of the present chapter, questionnaires were mailed by the counselors to (one of) the parents of each student respondent. Thus the returns represent approximately 54 percent of the possible number, based on 736 completed student questionnaires. The breakdown of the parent sample by age and sex is presented below. The average age of the parents was 44.8 years and 63 percent of the questionnaires were completed by females. Unweighted percentages for parents are reported in parentheses following weighted percentages.

	Parents	
Age	n	%
Under 35	13	5 (3)
36 to 40	96	24 (24)
41 to 45	122	34 (31)
46 to 50	86	16 (22)
51 to 55	51	10 (13)
56 to 60	16	6 (4)
61 to 65	8	5 (2)
66 or over	2	0 (1)

	Parents	
Sex	n	%
Male	152	37 (39)
Female	242	63 (61)

In order to estimate the generalizability of findings from our parent sample to parents with children of other ages, parents were asked to indicate the grades in which they have other children. Over 40 percent reported having children in grades 7 through 9 and 45 percent stated they have other children in grades 10 or 11. Slightly less, 27 percent, have children of elementary school age. Additionally, 267 parents (56%) said they have children who have already completed high school.

	Parents	
Grades of Other Children	n	%
K-6	146	27 (36)
7-9	174	43 (43)
10-11	167	46 (42)

Parents were also asked to indicate the highest grade they themselves had completed and to describe themselves with regard to their political views. Eighty-five percent of the parents indicated they have completed high school and 34 percent have college degrees (bachelor's or higher). Over 70 percent described themselves as conservative or middle-of-the road in their political orientation.

What is the highest grade you yourself completed?

	Parents	
	n	%
K-8	19	4 (5)
9-11	43	11 (11)
12	143	34 (38)
1-3 years college	68	17 (18)
4 years college	73	27 (19)
MA, MS, etc.	26	6 (7)
Dr	9	1 (2)

How would you describe yourself with regard to your political views?

	Parents n	Parents %
Conservative	140	42 (36)
Middle-of-the road	140	32 (36)
Liberal	73	11 (19)
Uncommitted	39	16 (10)

Finally, parents were asked to indicate the amount of attention they give to their 12th graders' school work and to the problems of their high school. The Ninth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools* asked parents whether or not they help their children with homework. Fifty-one percent of public school parents and 49 percent of parochial school parents reported yes, either on a regular basis or when needed. Almost all the parents in our sample said they devote quite a bit of attention to this. Similar proportions stated that they attend to problems and affairs of their children's high schools.

How close attention are you able to give to your 12th grader's work in school?

	Parents n	Parents %
No attention	18	3 (5)
A small amount	182	48 (47)
Quite a bit of attention	191	49 (49)

How much attention do you give the problems and affairs of that high school?

	Parents n	Parents %
No attention	40	6 (10)
A small amount	209	45 (54)
Quite a bit of attention	142	48 (36)

General Questions of Selected Groups. As earlier noted, the first page of each questionnaire in addition to the demographic and experience-related questions, contained one or more questions of a general nature regarding science education. The items that appeared on questionnaires for two or more groups are summarized on the following pages. Responses of counselors, students and parents are presented with both weighted percentages and, in parentheses, unweighted percentages. Superintendents, high school counselors, high school science teachers and parents were questioned regarding the amount of agreement that exists on the aims and responsibilities of schools.

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*George H. Gallup, "The Ninth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools," Phi Delta Kappan 59 (September, 1977) :33-47.

18:30

Parents, students, and teachers--talking among themselves or with others--say what they want the schools to be doing. They say different things, but do they really disagree?

	Superintendents		Counselors		10-12 Sci Teachers		Parents	
	n	%	n	%	n	%	n	%
People disagree fundamentally as to the aims and responsibilities of schools	17	29	9	17 (21)	9	24	21	16 (15)
People agree pretty much in principle, but disagree as to how to do the job	44	55	26	69 (59)	27	57	97	52 (67)
People really are pretty much in agreement with each other as to these things	8	6	8	11 (18)	4	17	21	30 (15)
Other	3	11	1	1 (2)	1	2	4	2 (3)

A majority in each group stated that people agree in principle on what schools should be doing, but disagree as to how to do it. Almost 30 percent of the superintendents said that people do fundamentally disagree while a similar proportion of parents said that people really are pretty much in agreement on the responsibilities of schools.

Counselors and parents were also asked to comment on how they feel about the efforts that school officials make to find out what people want the schools to do. Counselors' most frequent remark was that their school officials make a good effort to find out people's interests and concerns, followed closely by the feeling that little or no effort was made. There was no other common response. Parents' most frequent comment by far was that school officials make little or no effort to find out what people want, and where they do make such an effort, it needs improvement. About half as many parents reported they are pleased with or find adequate the efforts their schools officials make. The next most frequent response was that school officials do make an effort to find out what people want but do not listen, or at least do not act on what they hear. Some people said the school officials decide what they are going to do without checking with the people and then try to get support for these decisions. A few parents suggested that students' opinions should be sought and considered. There was also a feeling expressed that school officials have made an effort and now the public needs to respond.

Preparation of students for coursework in high school and possible reasons for their unreadiness was the topic of two items proposed to social studies supervisors of grades 7 through 12, science teachers in grades 7 through 9 and senior students. A majority of the social studies supervisors stated that children are being properly prepared for high school while 62 percent of the science teachers disagreed. Seniors were about evenly divided on this question. When asked for reasons why students might be unready, over 50 percent of both supervisors and teachers said it is because they are lacking in motivation; only 21 percent of the students agreed that this is a reason. Over 40 percent of supervisors and teachers and about 30 percent of students stated that elementary school programs have goals other than the preparation of students for high school. A majority of the students and one-third of the teachers indicated that one of the causes is the lack of emphasis on "content" in elementary schools.

> Some high school teachers say that children are not learning enough in grade school. Do you feel this is true, that children are not being properly prepared for high school?

	7-12 Soc Stud Supervisors		7-9 Science Teachers		Students	
	n	%	n	%	n	%
Yes	67	37	58	62	186	39 (50)
No	66	52	23	31	131	40 (35)
I don't know	13	12	9	7	55	21 (15)

> Think about those youngsters who are not ready for what high school teachers teach. What are one or more principal causes of their unreadiness?

	7-12 Soc Stud Supervisors		7-9 Science Teachers		Students	
	n	%	n	%	n	%
High school teachers expect too much	26	8	7	12	60	15 (16)
Elementary school teachers are poor teachers	6	0	4	3	30	6 (8)
Elementary school programs aim at other goals	75	42	44	46	131	31 (35)
The youngsters are lacking in motivation	64	56	59	59	103	21 (28)
Elementary schools emphasize "content" too seldom	39	20	27	34	183	56 (49)

Elementary school principals and principals of schools with grades 7 through 9 as well as parents were asked about grouping or tracking in schools. Elementary principals were evenly split on whether grouping of students with similar skills results in more effective instruction while principals of grades 7 through 9 and parents tended to believe that it does. A sustained and heavy emphasis on grouping is unfair to youngsters according to a majority of all three groups, ranging from approximately 70 percent of elementary principals and parents to 85 percent of principals of grades 7 through 9.

18:32

Do you feel that grouping youngsters of similar skills and experience into learning groups or tracks generally makes instruction more effective?

	Elementary Principals		7-9 Principals		Parents	
	n	%	n	%	n	%
Yes	31	46	23	62	92	56 (83)
No	22	47	10	28	16	43 (14)
Other	5	7	13	11	3	1 (3)

Do you believe it is unfair to some youngsters if there is sustained and heavy emphasis on such homogeneous grouping?

	Elementary Principals		7-9 Principals		Parents	
	n	%	n	%	n	%
Yes	44	70	32	85	58	69 (54)
No	13	29	13	14	45	28 (41)
Other	1	1	1	1	5	3 (5)

Considering both teaching effectiveness and fairness, which is the best policy?

	Elementary Principals		7-9 Principals		Parents	
	n	%	n	%	n	%
Put youngsters into tracks according to their learning ability	5	6	5	28	33	16 (30)
Don't use tracks but use grouping as much as is needed for good instruction	32	59	23	27	46	53 (41)
Occasionally use groups for a short while; occasionally group dissimilar kids	16	29	9	9	25	29 (23)
Except for very special activities, use no homogeneous groups for instruction	3	4	5	4	5	2 (5)
Other	2	2	4	32	2	0 (2)

Finally, these three groups were asked to select the best policy considering both teaching effectiveness and fairness. A majority of elementary principals and parents selected the option of using not tracks but grouping as much as necessary for good instruction; 29 percent say to group students only occasionally and then occasionally group dissimilar kids. Principals of grades 7 through

9 were more acceptant of the concept with 28 percent saying to track youngsters according to learning ability and another 27 percent agreeing to group for effective instruction.

In an open ended question, science and mathematics teachers of grades 7 through 9 were asked about any special efforts that are made to help students who have special talent in science or mathematics, respectively. Science teachers, responding to special efforts in science, noted extra-curricular activities and special incentives or privileges for science students. Mathematics teachers agreed with special incentives and privileges for mathematics students, but a majority also noted the use of special sections in mathematics. A number of teachers, approximately one-third in each disciplinary area, indicated that no special efforts are made, that all students are treated alike.

Elementary school mathematics supervisors, teachers and principals as well as science supervisors of grades 7 through 12 were asked about the background skills thought valuable for a curriculum supervisor. Mathematics supervisors and elementary teachers were specifically asked about mathematics supervisors while principals and science supervisors were asked about science supervisor skills. There was substantial agreement by all groups with the possibilities that were listed on the questionnaire. Those agreed upon by a majority of the respondents of all groups include recent fulltime teaching experience and knowledge of sources for curricular materials. A majority of all groups except elementary principals said that skill in diagnosing individual learning difficulties and an ability to "speak out" to protect the curriculum are also important skills for supervisors. The two groups of supervisors reported that they should have additional skills in interpreting test scores for classes or schools and the science supervisors said that administrative experience is helpful. Over half the principals wanted supervisors to be skilled in arranging inservice programs as did 50 percent of the mathematics supervisors. Over 60 percent of mathematics supervisors and elementary teachers also noted that knowledge of recent mathematical discoveries is an important skill for supervisors.

> Which of the following background experiences or skills do you think are highly valuable for a mathematics (science) curriculum supervisor or coordinator? (Check as many as you wish)

	K-6 Math Supervisor		7-12 Sci Supervisor		K-6 Principal		K-6 Teacher	
	n	%	n	%	n	%	n	%
Recent fulltime teaching exp.	89	89	110	59	55	96	74	97
Administrative experience	51	45	64	58	22	35	18	20
Continuing enrollment in graduate math (science) courses	34	43	60	19	20	31	22	27
Having done curriculum research and development	56	36	79	26	23	35	33	36
Skill in diagnosing individual student learning difficulties	90	83	65	76	27	43	62	83
Skill in arranging inservice programs	84	50	88	38	43	73	38	45

Valuable supervisor skills, continued	K-6 Math Supervisor		7-12 Sci Supervisor		K-6 Principal		K-6 Teacher	
	n	%	n	%	n	%	n	%
Skill in interpreting test scores for whole classes schools	64	54	41	53	18	30	34	42
Knowledge of recent mathematics (science) discoveries	61	64	74	35	25	39	49	64
Knowledge of sources of curricular materials	97	82	119	89	50	89	60	71
Ability to "speak out" to protect the curriculum	64	68	88	73	23	35	46	64

Mathematics supervisors of grades 7 through 9 and teachers of grades 10 through 12 as well as high school principals were asked about the "new math" and the effort that was made to reform the mathematics curriculum. Over a third of the principals and approximately one-fourth of the supervisors and teachers stated that the new math was a waste of time and money. A similar proportion of principals and a large number of supervisors (38%) said that it was probably the right thing to do, given the national situation; only 17 percent of mathematics teachers agreed. Of those who indicated that this movement tried to deal with the "grand sweep of things," they were about evenly divided as to whether that was good or bad. Of those who agreed that it placed a greater emphasis on formal logic, a large number of supervisors and teachers said this was a good attribute. Supervisors especially (37%) responded that the curriculum reform effort ignored the realities of time and cost to make such a change. The responses to this question indicate considerable diversity of opinion within each group regarding the new math curriculum reform effort.

> Modern math was taught for a while in a few classes in many schools. The regular textbooks now incorporate ideas from the "new math." But the old math survived. How do you feel now about the effort to reform the curriculum? (Check any number of times)

	7-12 Math Supervisors		10-12 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
It was a waste of time and money	9	23	14	36	28	28
Given the national situation, it was probably the right thing to do at the time	63	38	24	32	29	17
It tried to deal more with the grand sweep of things which was						
good	35	28	6	15	13	12
bad	31	37	6	10	17	14
It placed a greater emphasis on formal logic, and that was						
good	64	32	9	8	30	50
bad	15	11	6	17	14	21
It did not attend to the realities of time, costs, etc., involved in such a change	39	37	17	13	22	20
It gave a certain pride to math teachers, a pride which is missing now	18	11	5	6	5	3

A question administered to superintendents, science teachers of grades 10 through 12 and parents asked about the effect of declining enrollments in science. Substantial majorities of each group stated that this national trend will have a negative effect on almost all of the effects listed. These include the growth of technology, economy and "quality of life." Slightly smaller proportions, but still over 50 percent of all groups except science teachers, said that there will also be a negative effect on the military preparedness in this country. When asked if the schools should do something to reverse the trend of declining science enrollments, the answer was overwhelmingly affirmative. Thus, at least from a futuristic point of view, all three groups agreed that the decline in science education will have deleterious effects and that this decline should be reversed.

For many students the science goal "understanding the world in which we live" seems remote and impractical. Students now enroll in few science courses unless required to. Less science is being taught now than in earlier years. Do you think this national trend will have serious negative effect on...

...the growth of technology in our society?

	7-12 Math Supervisors		10-12 Sci Teachers		Parents	
	n	%	n	%	n	%
Yes	50	74	77	85	91	65 (73)
No	18	20	21	12	20	11 (16)
Don't know	5	7	2	3	14	24 (11)

...the economy of our country in years ahead?

	7-12 Math Supervisors		10-12 Sci Teachers		Parents	
	n	%	n	%	n	%
Yes	45	71	67	83	82	73 (66)
No	17	19	21	11	24	14 (19)
Don't know	11	10	12	7	19	13 (15)

...military preparedness in this country?

	7-12 Math Supervisors		10-12 Sci Teachers		Parents	
	n	%	n	%	n	%
Yes	32	57	47	44	61	51 (50)
No	26	32	35	35	31	17 (25)
Don't know	14	10	18	21	30	33 (25)

...the "quality of life" in this country?

	7-12 Math Supervisors		10-12 Sci Teachers		Parents	
	n	%	n	%	n	%
Yes	45	79	83	90	87	77 (70)
No	17	14	14	8	23	13 (18)
Don't know	10	6	3	2	15	10 (12)

18:36

Should schools try to do something to reverse the trend away from science?

	7-12 Math Supervisors		10-12 Sci Teachers		Parents	
	n	%	n	%	n	%
Yes	59	88	88	93	61	80 (69)
No	9	5	9	5	26	19 (30)
Don't know	6	7	2	2	1	1 (1)

RESPONSES TO SCENARIOS

The scenario portion of the questionnaire used an unusual concept in survey methodology. Various issues of pervasive concern were detected by the case study authors and site visitors in the eleven case study locations. A major purpose of the questionnaire was to evaluate the generality of the case study findings. A method was sought that would allow the formation of questions with categorized answers while preserving the complexity of the issues involved. Thus the scenario format was utilized as a technique to provide a setting against which relevant questions could be posed.

The many issues of science education were reduced and refined to eight fairly specific topics. A scenario was developed for each of the eight issues and consists of a contrived illustration, designed to establish the issue in proper context, and a number of questions relating to the issue portrayed in the illustration.

It would have been impossible to request all respondent groups to react to each scenario; such a procedure would have resulted in a questionnaire of unacceptable length. Accordingly, each scenario was included as a portion of the questionnaire to two, three or four of the twenty-two respondent groups. An attempt was made both to assign scenarios to groups with special interest in the particular issue and to assure that a variety of groups were queried on each issue.

As with all analyses in the present chapter, results are reported by both the actual frequencies of responses and the weighted percentages calculated on the sampling weights provided by the Research Triangle Institute. Standard errors are presented in Tables 18-1 and 18-2. As earlier noted, the weighted percentage responses for counselors, students and parents do not take the entire sampling procedure into consideration and thus must be interpreted with extra caution. Consequently, both weighted and unweighted percentages for these three groups are presented with the unweighted percentages in parentheses following the weighted percentages. Throughout the discussion of results, however, only the weighted percentages will be referred to. Percentages are based upon the number of persons who responded to a given question. Responses to most open-ended questions are reported only by actual frequencies of responses since many of these comments were analyzed manually.

Each scenario is printed in its entirety along with the responses to questions in this section of the survey results. Effort has been made to present the illustration portion exactly as it appeared in the questionnaire; however, the format of the questions has been altered in order to present findings in a tabled fashion.

Scenario S: Budget Cuts. A tightening of funds and the consequent effect on educational programs is a critical issue to educators and parents alike. The

Ninth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools* reports that lack of proper financial support was rated third in the list of top problems with which public schools must deal with 12 percent of the 1506 persons responding indicating this as a problem. As is discussed elsewhere in this chapter, the respondents in this survey indicated that budget problems and priorities is the biggest problem facing public schools when one-third of our sample was queried on this question. Scenario S was developed to assess opinion on budget cuts and possible ways to deal with decreased financial resources for education. This scenario was administered to superintendents, science supervisors of grades 7 through 12 and one group of parents. Response rates were 74 of 149 (50%), 139 of 200 (70%) and 111 of an estimated 250 (~44 %), respectively.

* * * * * * * * * * *

Please consider this situation:

School District No. 22 is facing key decisions regarding its programs. Funds are short. Rising energy costs and personnel salaries consume increasing proportions of revenues. Upcoming reassessments of real estate are provoking property owners into further resistance to reliance on the property tax for school funding. They are opposing an upcoming referendum on issuing additional revenue bonds. Financial aid from the state is based on formulas tied to average daily attendance, and for various reasons, attendance has been dropping each year. At least one school may have to be closed.

The staff is aggressive in seeking special state and federal programs that bring extra funds, but these funds only cover a small share of the total burden. A few teachers have been laid off, orders for new books have been cancelled, and laboratory work and field trips have been cut back. Art, music and athletic programs have been trimmed. Still the funds available will not meet the projected expenses.

The economic picture in the community is not particularly bleak. About 5% are unemployed. McDonald's is always trying to hire more teenagers. Filling stations and some shops have closed, but new businesses have been opening too. Sales of machinery, land, recreation vehicles and citizen-band radios have been going strong for quite a while.

A small number of citizens want to raise taxes to pay for a full and undiminished academic program. A clear majority does not. Some opponents claim the schools waste taxpayer money with frill courses, open classrooms, alternative teaching, and electives. Some claim that too much is being spent for administrators, curriculum coordinators, counselors, social workers and various office people.

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*George H. Gallup, "The Ninth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools," Phi Delta Kappan 59 (September 1977): 33-47.

Generally speaking and not with regard to particulars, how similar is the District 22 situation to the situation in your own school district?

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
quite similar	25	37	62	26	55	23 (51)
not very similar at all	43	60	51	67	43	65 (40)
other	60	2	23	7	9	13 (8)

This scenario was developed on the basis of economic conditions encountered in the case study sites. There was frequent talk of budget contraints. Only about one-fourth of the survey respondents to this scenario found the collage of conditions descriptive of their district. They were asked to elaborate on the similarities and/or dissimilarities in the following two questions.

What in this description of District 22 is particularly relevant to the situation in your own district?

What important differences are there between District 22 and your situation?

Parents made very few comments. Science supervisors and superintendents responded frequently with similar trends and proportions among their comments. The most frequently mentioned similarities between their own situations and District 22 were cutbacks in programs, decreases in attendance, teachers laid off or not replaced and shortages of funds. Comments that taxes are wasted by frill courses and too many administrators and concern with rising energy and personnel costs resulted in stated opposition to increasing taxes to support schools.

Major differences mentioned by superintendents included stability in attendance, no program cutbacks and no teachers being let go. Many said they enjoy community support for good school programs and several districts reported growing and expanding programs. Supervisors' comments were quite similar with the additional remark that there is no shortage of funds at the present time. In both respondent groups a few people noted that the economic picture in their districts is bleaker than in District 22. Thus, although a majority responded that the scenario representation is not similar to their own situation, in every detail, it would appear that economic constraints are seen to be serious problems as indicated by our field observers. Thus, there appear to be mixed reactions.

As enrollments drop and fewer courses are offered, teachers in some districts are involuntarily reassigned to other departments or to other schools.

Has this happened in your district?

Teachers re-assigned, continued	Superin-tendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Yes	34	54	70	62	29	22 (26)
No	37	45	59	29	36	40 (33)
I don't know	3	1	6	9	45	38 (41)

Involuntary reassignment appeared to be fairly common, although a smaller percentage of parents note this consequence of enrollment drops. If respondents answered yes, they were asked to elaborate further on the issue of reassignment. Following are the number and percent who answered yes to each question.

	Affirmative Responses					
	Superin-tendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Are teachers being given reassignments outside their certification?	5	15	18	45	4	3 (6)
Are reassigned teachers finding the new departments or schools hospitable?	27	40	48	32	9	26 (14)
Is it regularly the most recently hired teachers who are reassigned?	24	34	36	49	19	34 (28)
Is reassignment a much larger issue due to your collective bargaining agreement?	16	14	21	16	4	4 (8)

Science supervisors of grades 7 through 12 (45%) stated that teachers are being reassigned outside their certified areas and that it is the most recently hired teachers who tend to be reassigned (49%). Much smaller proportions of superintendents checked these options. Slightly more (40%) superintendents agree that reassigned teachers find new departments or schools hospitable. Reassignment is not a critical issue in collective bargaining, probably because it is viewed as part of the larger issue involving seniority and tenure concerns.

The following items were posed to determine the prevalence of budget cuts and their consequences and the action that would be preferred in the case of drastic cuts.

In what ways have budget cuts in your district seriously affected the science curriculum?

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
We have not had budget cuts recently	34	52	62	32	47	76 (42)
The science curriculum has not been seriously affected in any way	38	48	56	19	35	41 (32)
Classes have been made larger in size	7	4	50	17	17	4 (15)
Needed and highly qualified teachers have been "let go" and not replaced	4	6	10	2	5	3 (5)
We have more teaching from textbooks, less with projects and lab work	7	4	41	17	14	5 (13)
No longer can we provide a textbook for each student individually	0	0	15	4	3	1 (3)
The inservice training program has been cut back substantially	10	16	18	3	6	1 (5)
Other	10	16	18	43	9	3 (8)

A majority of superintendents and parents reported no recent budget cuts and large portions, 48 and 41 percent respectively, indicated no effect on the science curriculum. Supervisors, however, appeared to disagree with only 19 percent reporting that budget cuts have not affected science curriculum. Other consequences especially noted by supervisors were larger classes and more textbook teaching, both 17 percent. Under other comments, cuts in budgets for equipment and supplies that result in the reduction in purchases of new materials and equipment were noted; money is unavailable for anything other than books. Finally, cutbacks in lab assistants and, consequently, on lab experiences for students were listed as other consequences of budget constraints.

Suppose you live in a district which must make drastic cuts in the school budget. Give a rank of "1" to the action you would consider most acceptable, a "2" to the next, on down to a rank of "8" to the action most unacceptable to you.

Rank first or second

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
A 15% reduction in funds for administrative salaries	14	10	55	32	49	39 (62)
Weighted median rank	4.4		3.8		2.2	
A 3% reduction in funds for teacher salaries	16	15	25	11	38	36 (40)
Weighted median rank	4.3		3.4		4.8	
A five year moratorium stopping purchase of new books and materials	13	21	19	17	16	27 (17)
Weighted median rank	4.4		6.3		3.4	

Ranking of budget cuts in order of acceptability, continued	Rank first or second					
	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Elimination of all extra-curricular activities except sports	34	63	53	59	31	40 (32)
Weighted median rank	2.1		2.3		3.0	
Elimination of the athletic program	32	67	47	19	21	28 (22)
Weighted median rank	2.2		4.6		4.5	
Elimination of the foreign language and bilingual education programs	11	27	23	58	20	20 (21)
Weighted median rank	5.6		1.9		4.8	
Elimination of the locally-funded assistance to handicapped children	2	3	15	6	9	5 (10)
Weighted median rank	5.2		6.0		7.0	
Elimination of all physics and chemistry courses	3	9	2	1	4	1 (4)
Weighted median rank	7.0		7.8		7.1	

The most desirable action in parent responses to budget cuts was a 15% reduction in administrative salaries (median rank 2.2). Also considered relatively acceptable by parents were elimination of extra-curricular activities except sports and a five year moratorium on purchase of new textbooks and materials. This last option was ranked much lower by supervisors; perhaps parents tended to see the curriculum as more static. Secondary school supervisors ranked elimination of foreign language and bilingual education programs as the first to be cut. This choice ignores the fact that bilingual programs are primarily funded from funds external to a district. They, along with superintendents, also ranked elimination of all extra-curricular activities except sports as relatively acceptable. Superintendents also chose elimination of the athletic program, although it is possible that this is a popular "pressure-tactic" choice.

The least acceptable choice to all three groups was elimination of all physics and chemistry courses. It may be speculated that this is because of the importance of these courses, but it may also be that they feel the elimination of these courses would not result in the same amount of savings as would some of the other options. Our respondents also may have been influenced by the sponsor of the survey. Many respondents in all three groups found none of the alternatives acceptable. Several suggested making multiple compromises such as cutting back slightly on all items rather than eliminating any one area.

Finally, these groups were asked to respond to several questions concerning youth unemployment and vocationally oriented coursework.

18:43

Here are questions about youth unemployment and school curriculum.

Science courses should be aimed (more than they are) at vocational goals.

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Agree	38	59	69	34	67	64 (60)
Disagree	27	27	52	28	16	14 (14)
Uncertain	7	15	17	38	28	22 (25)

Many youngsters are not ready for work, but the big problem is the scarcity of jobs, not what the schools are doing.

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Agree	36	63	59	63	50	49 (45)
Disagree	22	12	52	25	18	24 (16)
Uncertain	13	26	26	11	43	28 (39)

Schools should be teaching youngsters how to get a job and how to keep it.

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Agree	55	72	87	34	77	79 (69)
Disagree	10	6	33	16	7	1 (6)
Uncertain	8	23	16	50	27	20 (24)

Most employers do not expect a new worker to be ready for the responsibility of a particular job, no matter how well they have done in high school.

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Agree	30	38	48	16	47	30 (43)
Disagree	36	41	78	78	12	31 (11)
Uncertain	7	21	13	6	51	40 (46)

Slow learners should not be required to take a science course in high school.

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Agree	4	7	15	7	16	25 (14)
Disagree	66	92	119	93	16	4 (14)
Uncertain	3	1	5	1	79	71 (71)

If there is not enough money for both, high schools should offer good general education rather than good vocational education.

	Superintendents		7-12 Science Supervisors		Parents	
	n	%	n	%	n	%
Agree	42	66	97	79	73	76 (66)
Disagree	18	25	26	14	9	3 (8)
Uncertain	10	9	15	7	28	20 (26)

A majority of superintendents and parents stated science courses should be aimed more at vocational goals. While substantial proportions of all groups said that the big problem is with scarcity of jobs for youth, over 70 percent of superintendents and parents stated that schools should teach youngsters how to get and keep a job. Yet large majorities of all groups would opt for a good general education as opposed to vocational if a choice had to be made. Apparently, the choice between general and vocational education is clear, but there is still a large concern for the latter. Finally, overwhelming proportions of superintendents and supervisors thought that slow learners should not be exempted from high school science courses. Parents were not so sure on this issue with 71 percent indicating that they are uncertain.

Scenario T: Uniformity. Chapter 14 of this report considers, in detail, the issues of pluralism and uniformity, an important topic both in conversations during case study research and in the current educational literature. Goal setting, having similar goals for all schools and minimum competencies are all related to this emphasis on uniformity. Scenario T, presented as correspondence among parents, teachers and administrators, was developed to probe the generality of these concerns. Science supervisors, this time for elementary grades of kindergarten through 6, principals of schools with grades 10 through 12, and parents were asked to respond to this scenario. Response rates for these groups were respectively 134 of 210 (64%), 54 of 87 (62 %) and 142 of approximately 250 (~ 57%).

* * * * * * * * * *

Please consider the following "correspondence."

Dear District Administrator,

The PTA-Council is thinking that it would like to set the theme for next year's meetings as something like "Putting the Curriculum in Uniform." We want to stress the need for uniformity of teaching across the district and the need for encouraging learning that leads to good employment opportunities. Please let me know your reaction to this tentative choice.

Respectfully, Willa Petrun, President

Dear Mrs. Petrun,

You will be hearing from others on the staff. For myself, I am pleased with your choice. Discussion on this theme will help draw attention to our objectives-based curriculum and the importance of providing equal opportunity for learning in each of our schools. If we are going to be fair, we must be uniform.

Sincerely, Jarvis Shattuck, Superintendent

Dear Willa,

I look forward to working further with the Council. I think the title, "Putting the Curriculum in Uniform," is corny and hope you find a better one, even if the topic is "uniformity."

I am disappointed, I must admit, that you did not choose the theme sponsored by Mr. Perez, "Where is our Science Program?" I feel that more emphasis on uniformity is going to further erode support for our college-prep program. We have lost support from the Board because we do not have their endorsement on a set of objectives for the sciences. They don't fund what we don't specify. I hope the Council will give Mr. Perez's proposal further review.

Your "favorite" science teacher, Foster

Dear Ms. Petrun:

Thank you for giving us the opportunity to influence your consideration of themes for next year. In as much as the state legislature will be voting on bills to create a Competency-Based Diploma, I think we should review our entire philosophy of curricular uniformity in the district.

Uniformity could be an obstacle to providing an educational program tailored to each student's home-culture, talents, and aspirations. Uniformity could diminish the flexibility we have had in our alternative school and magnet school. We should be discussing uniformity this year, and of course, we should recognize that too much of it can be as troublesome as too little.

Yours truly, Mavis Cooper, Principal, Central School

* * * * * * * * * *

> These letters summarize some of the concern about the curriculum. Some people are wanting courses to be more uniform, so that, for example, all sixth grade math courses and all American history courses are alike. What do you think about it?

	K-6 Science Supervisors		10-12 Principals		Parents		
	n	%	n	%	n	%	
I think that much more uniformity is needed	27	23	12	11	56	31	(41)
I am opposed to a high degree of uniformity	58	53	24	50	57	47	(41)
I would like more uniformity, but getting it will cause problems too	28	17	10	18	20	8	(14)
Other	16	8	7	21	5	15	(4)

Approximately half of the persons responding were opposed to a high degree of uniformity although about one-third of each group either desired more uniformity or would do so if it did not cause problems. An item related to the question of ethics of uniformity versus pluralism and a sample of responses was asked next.

> Superintendent Shattuck implied that the same courses in different schools have to be alike if the school system is to be fair. Do you believe this is so?

Supervisors and principals gave three times as many negative responses as positive. Parents, in the majority of their responses, however, agreed that schools should be alike if the school system is to be fair. The parents responded more often with a simple yes or no than supervisors and principals who tended to elaborate on their responses. The most frequent qualification to affirmative responses among all three groups was that while uniform minimum standards could be set, the individual differences among teachers, students, and schools would make it impossible and undesirable for programs and outcomes to be the same. Parents also mentioned that uniformity within courses would facilitate adjustments when children move or transfer from one district to another.

The role of parents was especially of concern in the next item. Here, and elsewhere in the questionnaire, an attempt was made to solicit attitudes about other peoples' perceptions, but the respondents were rather reluctant to provide these, as evidenced by the number of "Don't know" answers. In general, the groups responded similarly with about one-third stating that parents have a large voice in school goals. Within each response group there was apparent lack of consensus on the issue of the manner in which school officials respond and whether or not more uniformity is desired by parents.

18:47

In your own community, generally speaking . . . how large a voice do parents have in school goals?

	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
Large	47	35	19	38	31	31 (24)
Small	75	52	32	61	84	56 (66)
None	7	13	2	6	13	12 (10)

do school officials respond as these three did here?

	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
Yes	64	56	31	43	41	33 (32)
No	25	27	12	38	26	20 (20)
Don't know	30	18	9	19	61	47 (48)

do most parents want more "uniformity" across schools?

	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
Yes	65	42	26	35	53	28 (39)
No	15	23	9	32	18	24 (13)
Don't know	39	36	16	33	64	48 (47)

The three items following were designed to determine the number who agreed with the different positions indicated by various correspondents in the scenario.

Do you agree with the concerns Mavis Cooper raised with regard to "uniformity?"

	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
Yes	104	83	46	97	90	76 (66)
No	22	15	4	2	34	16 (25)
Other	4	2	2	1	13	9 (9)

Foster seems also to be suggesting that the science curriculum is competing with the objectives-based curriculum--rather than being supported by it. Do you feel that funding for the one, if spent properly, would support the other? Or do you feel that districts just have to make hard choices between traditional and objectives-based studies?

Traditional versus objectives-based curriculum, continued	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
The methods and goals of traditional and objectives-based curricula are relatively independent; therefore, they compete for funds.	11	15	6	21	53	44 (43)
The methods and goals of traditional and objectives-based curricula are highly related; therefore, they do not really compete for funds.	108	84	39	67	65	53 (53)
Other (please indicate)	2	0	2	10	5	3 (4)

Do you agree with Willa Petrun that schools should give more emphasis to studies that lead to employment opportunities?

	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
Yes	88	57	41	78	107	73 (80)
No	29	21	7	17	21	24 (16)
I don't know	12	22	4	4	6	4 (5)

An overwhelming majority agreed with the principle that uniformity can be an obstacle in providing educational programs tailored to each student , and high proportions did not think that traditional and objectives-based curricula are in conflict and thus compete for funds. In both cases, the proportion of parents agreeing was slightly less than K-6 science supervisors and 10 through 12 principals. Again, as in the scenario on budget cuts, we see a substantial concern for employment related coursework, although this concern is not quite so evident among the science supervisors.

In one city recently, science teachers in elementary, junior high and senior high schools expressed a strong desire to clarify what should be taught in each grade. What do you think are major reasons teachers seek such clarification? (Check one or more)

	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
To make their jobs more manageable	67	44	28	72	63	47 (44)
To locate the blame when deficiencies are found	15	8	12	34	32	19 (23)
To make clear to students what is expected of students	79	54	33	59	72	49 (51)

Major reasons for course clarification, continued	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
To persuade Board and Community to support some areas better	9	6	6	6	29	17 (20)
To select the best materials from the huge supply	47	35	17	28	47	38 (33)
The reasons are different from community to community	33	43	19	24	36	21 (25)
There really are no reasons; maybe it's a "panic" response	5	4	1	1	10	5 (7)
Other (please specify)	28	23	9	9	7	3 (5)

When there is an expressed desire on the part of teachers to clarify goals, what are the possible motivations? Substantial proportions, especially of 10 through 12 principals, said this desire is due to a need to make the job of teaching more manageable. Other reasons that were checked by a proportion significantly greater than zero include locating the blame (principals and parents only), making expectations clear to students (approximately half of all respondents), and assisting in text selection (approximately one-third of the respondents). Significant proportions, although smaller for principals and parents than for science supervisors, stated that the reasons for goal clarification differ from one community to another. The "other" responses given by supervisors were primarily related to assuring continuity or articulation through all grades. This was a concern both in planning the curriculum to avoid duplication and in the classroom so teachers will know what their students have been taught previously.

The Eighth Annual Gallup Poll* (1976) reported that 65 percent of people believe high school students should be required to pass a standard nationwide examination for graduation. This is a substantial increase over 50 percent who responded similarly in 1958. An indication of the national interest generated by this issue, as noted by Nolan,** is the proposal for a national test in reading, writing and mathematics by the Chairman of the State Subcommittee on Education.

Should school districts set some minimum competency in science for all students to attain in order to graduate from high school?

	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
Yes	85	69	41	70	90	77 (71)
No	32	21	10	27	24	18 (19)
I don't know	15	10	3	3	13	5 (10)

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*George H. Gallup, "The Eighth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools," Phi Delta Kappan (October, 1976): 187-200.

**David M. Nolan, "Washington Notes: National Standards," NCME Measurement News, 20-111:7 (Fall, 1977).

The high proportions agreeing with this statement may be partially due to the fact that control might be vested in local school districts as opposed to a nationwide examination. Even so, the support for minimal competency in science is impressive and might be taken as a general commitment to the importance of science in our society. On the other hand, it must be cautioned that the preceeding question does not define the term "minimum competency" nor does it indicate any costs or benefits of implementing such a program. It may be simply that the responses are much more indicative of a desire to set tougher standards for high school graduates. Science is already required and the above respondents may be reaffirming their commitment to retain that requirement.

It should be noted that an identical question appeared on one of the three fourth pages and was responded to by representatives from all groups. Agreeing were 70 percent of the supervisors, combined across all grades and disciplines, and 67 percent of the parents, proportions similar to those preceeding. However, a combined group of superintendents and principals of all grade levels responded "yes" in only 37 percent of the cases, indicating less agreement by the superintendents and principals of grades other than 10 through 12.

> Please rank the importance of responsibilities of a science curriculum supervisor--as you would like it to be. Rank "1" as the most important on down to "5" as the least important.

	Ranked first or second					
	K-6 Science Supervisors		10-12 Principals		Parents	
	n	%	n	%	n	%
Assist teacher with problems they are having with teaching	117	89	42	87	60	41 (47)
Weighted median rank	1.3		1.4		2.5	
Supervise the collection of student performance data	3	4	3	8	15	7 (12)
Weighted median rank	4.2		4.7		4.0	
Assure that a high level of subject matter is maintained	36	34	28	61	93	69 (74)
Weighted median rank	2.9		2.2		1.4	
Provide information about different teaching methods and materials	99	73	29	45	65	63 (53)
Weighted median rank	2.1		2.8		2.2	
Assist administrators in getting funding for programs	6	1	2	1	22	12 (18)
Weighted median rank	4.6		3.8		4.5	

There is at least some small disagreement over what supervisor responsibilities should be as evidenced by the above rankings. Secondary principals and elementary science supervisors assigned assisting teachers with problems they are having with teaching the highest rating while parents chose assuring maintenance of a high level of subject matter. This choice was ranked second by supervisors and third by principals. All three groups indicated that providing information about different teaching methods and materials is important, although not the most important responsibility.

> In your district, who is the person (or who are the persons) most knowledgeable about whether the curriculum needs improvement of one kind or another?

Kindergarten through 6 science supervisors thought those most knowledgeable about the curriculum were the classroom teachers, followed by curriculum personnel, principals and superintendents. High school principals felt they knew most about needs for curriculum improvement, followed closely by teachers and curriculum personnel. Parents thought teachers were most knowledgeable, followed by principals and superintendents. Curriculum personnel were mentioned far less by parents, perhaps indicating that many are not aware of the role of curriculum coordinators or supervisors in the schools or districts. Many parents responded, "I don't know." Parents, high school counselors, students and the school board were given occasional mention. Parents were the only group to mention employers in the business and industrial community as knowledgeable about the school curriculum because they are hiring former students.

Scenario U: Back to the Basics. Hand in hand with the question of examinations for minimal competencies is the emphasis on basic skills. The "basics" are often regarded as reading, writing, and arithmetic--the case studies indicate that the current definition primarily refers to simple reading and arithmetic skills. Chapter 13 elaborates the issue of back to the basics and how these skills are being viewed.

In the 1977 Gallup Poll,* 41 percent of all parents had heard of the back to basics movement in education. Interestingly, many parents in that poll also saw the movement as a back-to-the old fashioned ideas--of discipline in the school room and of teaching methods. Of those who were aware of the phrase, an overwhelming majority of 83 percent reported that they approved of the movement.

A scenario was designed using a setting of two teachers at a curriculum workshop to explore the back to the basics issue in the context of writing objectives. This scenario was presented to the social studies supervisors of grades 7 through 12, elementary school principals (K-6), and to mathematics teachers of grades 10 through 12. Response rates for these three groups were 153 of 201 (76%), 59 of 94 (63%), and 94 of 150 (63%) respectively.

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*George H. Gallup, "The Ninth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools," Phi Delta Kappan 59 (September 1977): 33-47.

Please consider this dialogue between two teachers, Maria and Jim, at a curriculum workshop:

Maria: It's a lot of work, but I'm glad we are specifying just what our curriculum is. The more specific we are the better. It should help us concentrate on teaching the basic skills.

Jim: But are we really describing the old curriculum or creating a new one? With the new mastery requirements will we have time to do enrichment projects and science explorations?

Maria: We've spent too much class time on field trips and science fairs. We must set our priorities and spend the time where it should be spent: on reading, writing and arithmetic. Knowing what we need to teach will help us use tests to make sure we did it. We will eliminate the irrelevant topics and unrealistic goals.

Jim: I'm not that optimistic. Three summers ago I revised a course using behavioral objectives. But in the fall I felt tied down to them. They seemed too narrow, too simplistic. So I stopped bothering with them.

Maria: Well, we are not writing behavior objectives. We are dividing the curriculum into mini-units and constructing mini-tests. Next year we will be able to show exactly what we have covered and what each student has learned. There is nothing narrow about this; if we want students to know complex relationships, we just say so.

Jim: I wish you luck. Dan Thorpe told me that in the competency-based math at his school, the tests do not accurately represent what the students know. No matter what competencies they would specify, they always ended up teaching and testing for the simpler things, leaving out lots of complex things. It bothers me.

Maria: I'm not worried if the tests do not reflect the complexity of knowledge. Our job is to make sure that every boy and girl has the minimum competencies to continue to the next grade or graduate. They need to know the basics in order to get along in today's world.

* * * * * * * * * *

Are your feelings more like those of Maria or Jim?

	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
Maria	40	37	19	30	26	48
Jim	18	4	7	10	13	10
Neither	10	14	6	9	10	8
A little of both	78	45	25	46	44	34
Other	5	1	1	6	1	1

Is the issue "Back to the Basics" important in your community?

"Back to the Basics," continued	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
Yes, an important issue	117	63	43	72	66	63
No, but it should be	15	15	2	3	17	28
It was, but is no longer	2	1	0	0	1	0
No, not an important issue	13	21	10	23	8	9
Other	0	0	2	2	0	0

As was expected, a majority in each group reported that "Back to the Basics" is an important issue in their communities. Additionally, 28 percent of the mathematics teachers stated that although the issue is not important, it should be.

Almost half of the social science supervisors and elementary prinicpals stated that they have ambivalent feelings - a bit like both Maria and Jim in the scenario situation. A slightly smaller proportion of secondary mathematics teachers indicated ambivalence with 48 percent feeling like Maria. In order to probe further the personal attitudes of the respondents, the following free response item was included.

> What is your own feeling about increasing emphasis on teaching basic skills and knowledge?

The majority of all three respondent groups agreed with the importance of teaching basics, many stating their emphasis should be increased. Several people in each group also commented that they had never stopped emphasizing the basics. In all three groups the need for balance between basics and such things as creativity, progress, critical thinking, reasoning, individualism and flexibility was stressed frequently. In addition, they mentioned that minimal standards should be established for basic skills and knowledge and that these must be met by all students before progressing either to the next grade level or to more complex learning. Judging from their comments, the 10 through 12 mathematics teachers as a group were more likely to interpret "basics" as skills specifically related to their content area, and, given acquisition of the basic tools, students could progress through a sequential learning progress into more complex areas. A few respondents in each group supported increasing emphasis in basic skills and knowledge, particularly at the elementary level.

> Maria is pleased to be dividing the course content into small units and to be specifying competencies in each. Which of the following results do you think will be accomplished more effectively by this approach? (Check as many as you wish)

Effect of molecularization, continued	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
Setting of priorities and allocating time for instruction	114	67	49	86	69	80
Removing unimportant matters from the curriculum	60	45	14	15	38	57
Raising or maintaining high standards of achievement	48	41	23	53	32	40
Giving teachers more flexibility and freedom	26	29	8	10	6	5
Making courses more relevant to the pupil's experience	45	41	26	31	26	23
Other (please specify)	15	12	1	1	9	7

There was general agreement that Maria's molecularization activities would lead to setting priorities and allocating time for instruction more effectively and, in addition, would raise or maintain high standards of achievement. Social studies supervisors and secondary mathematics teachers disagreed with elementary prinicpals, with a significantly larger proportion of the former indicating that molecularization would result in unimportant matters being removed from the curriculum. Of the three groups, the mathematics teachers were the least optimistic about these activities leading to courses that are more relevant to pupils' experiences.

> Some people urge a big push to teach reading skills and math facts alone at first. Other people say you need to teach lots of basic information while teaching the skills. Others say "teach analysis and even interpretation at the same time." What do you say?

	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
I say "Teach the basic reading and math at first, the other things later."	40	26	21	36	39	57
I say "Teach the basic skills and lots of content first, leave analysis for later."	23	14	12	15	24	17
I say "Teach all those things together, all the time, in every grade."	70	38	22	45	23	20
Other (please specify)	13	22	3	5	7	6

Secondary social studies supervisors disagreed with mathematics teachers in the proper sequencing of teaching skills, the former indicating that analysis and interpretation may be taught along with basic skills (38%) while the majority of the teachers said that basic reading and math should be taught first.

Elementary principals were about equally divided on this question but all groups disagreed with teaching basic skills and lots of content first with analysis later.

The following item was included to explore the relationship between scientific knowledge and the "basics." All respondents disagreed that scientific knowledge is needed by only a few people, but a majority said that, although science is basic, the 3 R's must be taught first. Although proportions are small, a number of supervisors and principals stated that stressing the 3 R's indicates a lack of understanding of present educational needs.

> Some people think that scientific knowledge is "basic." Why are reading, writing, and arithmetic usually mentioned as "the basics" in elementary education and not science?

	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
Only a few people really need scientific knowledge	0	0	1	1	0	0
Science is basic but you have to teach the 3 R's first	80	51	31	60	63	71
Science can better be learned outside the elementary school	4	7	0	0	2	1
People who stress the 3 R's do not understand today's needs for education	40	16	13	18	8	4
Other (please specify)	23	26	13	22	18	24

What areas need the most attention at present is the essence of the next five items. The majority of elementary principals and secondary mathematics teachers agreed that teaching of "prerequisite skills" and specification of course objectives are receiving about the right amount of attention while social studies supervisors indicated that more attention should be directed to the first and were equally divided on the second. All tended to agree (approximately 60%) that the right amount of attention is being directed to abstract ideas and concepts. Fewer supervisors (46%), but more principals and mathematics teachers (~75%), responded similarly about emphasis on facts, rules and techniques. On the last item setting minimum proficiency levels, a majority of both the supervisors and teachers stated that more attention is needed. The only response significantly greater than zero indicating less attention is needed was that of social studies supervisors to the need for emphasis on facts, rules and techniques.

A general conclusion might be that principals are saying that things are okay at elementary schools, and, although it would be nice to emphasize everything more, that is not possible. Mathematics teachers say that the high school curriculum is fine except for more emphasis on setting standards and maybe a little more on teaching prerequisites. In contrast, the social studies supervisors are more distressed and want more on prerequisite skills and proficiency levels but less on facts, rules and techniques. Their responses are somewhat perplexing; perhaps they have received criticism for "teaching the facts" in social studies; perhaps they think the facts are sufficiently covered and more attention should be given to other aspects of the curriculum.

Please indicate the attention needed at present in the curriculum in your school:

	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
Teaching of "prerequisite skills":						
Needs more attention	86	63	18	31	63	41
Amt of attn about right	56	35	37	69	31	59
Needs less attention	3	3	0	0	0	0
Specification of course objective:						
Needs more attention	76	52	21	28	20	16
Amt of attn about right	65	45	33	68	66	79
Needs less attention	7	4	2	4	6	5
Emphasis on abstract concepts, ideas:						
Needs more attention	46	35	17	32	19	29
Amt of attn about right	81	59	34	61	61	62
Needs less attention	16	6	5	6	11	9
Emphasis on facts, rules, techniques:						
Needs more attention	31	30	12	23	36	23
Amt of attn about right	82	46	40	73	53	75
Needs less attention	28	24	3	4	4	2
Setting minimum proficiency levels:						
Needs more attention	89	64	24	41	63	70
Amt of attn about right	53	34	29	52	26	25
Needs less attention	7	2	3	6	3	5

In some communities students are graduating from high school even though they are not capable of reading and doing arithmetic. Why is this happening? Do you think...

	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
...the teachers are too lax?						
Yes	45	49	17	30	33	20
No	67	40	28	57	46	74
Don't know	16	12	9	13	10	6

Why students are incapable, continued	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
...the teachers are incompetent?						
Yes	9	7	8	17	9	7
No	96	70	36	67	68	85
Don't know	16	22	9	16	11	8
...Government regulations, laws, and court rulings are making schools promote unqualified students?						
Yes	78	52	23	50	56	77
No	35	41	27	43	17	13
Don't know	21	7	6	7	19	10
...the books they use are inappropriate?						
Yes	25	18	11	21	10	9
No	74	58	34	69	61	77
Don't know	22	25	8	10	18	15
...the schools just push "poor learners" through to get rid of them?						
Yes	78	63	26	53	74	73
No	32	30	26	36	11	24
Don't know	17	8	7	12	5	3

The preceding questions were to assess the reasons for some students graduating from high school with low level basic skills in reading and arithmetic. All agreed that textbooks are adequate and that teachers are competent; however, more supervisors than principals and mathematics teachers said that teachers are lax. External interference as denoted by government regulations and court rulings was viewed as responsible by 77 percent of the mathematics teachers; the other two groups were more evenly divided on this issue although over 50 percent agreed that this is true. A majority of each group indicated that one source of the problem is "poor learners" being pushed through by schools in order to get rid of them. In general, the "inanimate" agents - government and schools - received the blame. This was not true for textbooks although the personal experiences of many of the case study authors and site visitors indicated that some teachers did stress the inadequacy of texts and complained that "their" kids could not handle them.

> For a number of reasons students in many classrooms are becoming (as a group) more and more heterogeneous in learning ability and motivation. Is this a major problem for teachers?

	7-12 Social Studies Supervisors		K-6 Principals		10-12 Math Teachers	
	n	%	n	%	n	%
Yes	81	45	24	55	47	50
No	49	20	27	37	28	23
I don't know	20	35	6	8	17	27

Grouping was often viewed as facilitating the teaching process. Slightly more respondents in each group agreed that heterogeneity in learning ability and motivation is a major problem for teachers. When asked to comment on what should be done about this problem, only mathematics teachers were at all emphatic in their support of more homogeneous groupings. Other comments by the three groups included such suggestions as increased inservice and staff development to help teachers deal with the greater heterogeneity within classes, greater emphasis on individualizing instruction, and more support personnel and/or more teachers. In addition, increased attention to development of instructional materials and procedures with varying levels of difficulty to help deal with individual differences and smaller classes were often mentioned. The teachers also suggested enforcing achievement of minimum competencies before promotion to the next level.

Scenario V: Diagnostic Teaching. A major controversy over declining test scores is currently in the news.

> *The "new math" movement, which was extensively promoted during the 1960's, has come under a barrage of criticism and a new movement - "back-to-basics" - has been gaining momentum. People complain that the new math produced a generation of computational cripples who are seriously hindered in their attempts to use mathematics in school and in their daily lives.**

Opponents of the new math programs cite the decline in scores on Scholastic Aptitude Tests (SAT), the Iowa Test of Basic Skills and the Comprehensive Tests of Basic Skills. Proponents argue that the declines were not confined to mathematics and are therefore more indicative of generalized lower academic performance. Furthermore, they point to the first results of the testing by the National Assessment of Educational Progress in which 9 and 13 year-old students performed well in whole number computations but poorly in conceptual areas such as geometry and measurement. Additionally, the 13 year-olds computed nearly as well as did the adult control group and the group of 17 year-old students computed better. All age groups tried to work problems with a one step approach or by using recall. Thus defenders of the new math programs conclude that computational ability is independent of whether people were taught by the new math or traditional methods and that neither method results in learning of important concepts.**

One of the issues found by the case study field workers was the problems that teachers have in teaching mathematical concepts, regardless of whether the new math or traditional programs are used. Closely related to the problems of teaching concepts is the availability of someone with whom teachers may consult when they run into difficulties.

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*Gina Bari Kolata, "Aftermath of the New Math: Its Originators Defend It," Science, 4 March 1977, pp. 854-857.

**Math Fundamentals: Selected Results From the First National Assessment of Mathematics, January 1975, Mathematics Report 04-MA-01.

The scenario developed to evaluate these problems was based upon an actual incident related by a mathematics teacher. This is one of the more specialized scenarios and as such was given to elementary mathematics supervisors and mathematics teachers of grades 7 through 9. Response rates were 116 of 198 (57%) and 81 of 150 (54 %) for these two groups.

* * * * * * * * * * *

Please consider this dialogue as a teacher visits a math consultant:

Teacher: I gave 2 + .3 = ? to Tom. He rewrote it on his paper like this: and wrote down the answer, .5 and said, "point five."

$$\begin{array}{r}2\\ \underline{+.3}\end{array}$$

Tom works hard. I believe he likes the individualized math program that we have here in the sixth grade. He has had those problems lots of times. He may not get them right the first time, but he corrects them and is done before the other kids!

I drew three rectangles and asked him to show me what 2 + .3 would be, "using rectangles." He divided one into ten parts, shaded 3 of the parts, then shaded the other two rectangles and said, "The total is two and three tenths."

I pointed back to the .5 and said, "This answer is different. Which is correct?" He said, "Both are correct." I said, "But we started out both times with the same question. How could both answers be correct?" He said, "It depends on the key."

And I guess Tom *taught me* something when he said, "I'll show you. If I have the problem 2 + .3 = ? and I put down 2 3/10 for my answer, I get it marked wrong. If I have this one (pointing to the rectangles) and I put down .5 I get it wrong. So to get it right, I have to figure out what the key wants."

Mathematics Consultant: This is not uncommon in these individualized programs, but I never heard it expressed with such conviction.

I doubt if you can change his view of the "arbitrariness of scoring-keys" overnight. Lots of kids think math is just a bunch of disconnected rules. Emphasizing "place value," that you can't put 2 and .3 in the same column, seems unrelated to the idea of 3 parts out of 10, 3/10.

What I would look for is the "analog" he has, the incorrect rule that *does* allow him to put 2 and .3 in the same column. What is his logic? If you find that, you may be able to persuade him that the answer ".5" will always be wrong to this question.

Teacher: Are there some materials I could use to help with this problem?

Mathematics Consultant: I know of some you could try, but you will have to have time to study them carefully yourself. Students see the different formats and conclude that "each is a different kind of arithmetic."

* * * * * * * * * * *

Have you found bright students in mathematics classes who are somehow unable to discriminate between significant and insignificant details, bright students who fail to get the "big picture?"

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
It is rather common	61	50	32	34
There are a few rare cases	48	50	42	55
I do not know of any such cases	3	1	7	11

Do you find that this type of problem occurs more often with a specific type of instructional method?

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
More often with individualized instruction	43	29	23	29
More often with group recitation	14	23	4	6
No difference	45	40	34	50
Other	8	9	10	16

Elementary mathematics supervisors were evenly divided on the prevalence of the problem illustrated in this scenario while a larger proportion of mathematics teachers stated that the problem is less common. Almost 30 percent of each group indicated that the inability to discriminate between significant and insignificant detail is likely to occur with individualized instruction, perhaps because of the independent nature of this method. Larger proportions, 40 percent of supervisors and 50 percent of teachers, stated that these problems are independent of instructional method.

If you were Tom's teacher, how would you deal with this problem of his?

The mathematics teachers' most common approach to Tom's problem was reteaching or explaining place values, followed by demonstration of the relationship between decimals, fractions and whole numbers. They also mentioned emphasizing the consistency of mathematical laws regardless of the "key." The response most frequently given by mathematics supervisors was to build on Tom's knowledge of fractions by showing their connection with decimals. The second most frequently cited approach was to give practice with real life examples (such as money) to promote understanding of the concept. Other suggestions included individual work with Tom, re-teaching place values, trying to understand his "logic" and modifying teaching methods and materials on that basis and providing more problems to work. Further details on the responses to this question are presented in Chapter 16.

Two questions were asked to assess the kinds of support needed by teachers and kinds of activities that would be helpful if available. Supervisors selected a network of fellow teachers as the most pressing need while teachers were about evenly divided between this option and teacher centers to which teachers can take their problems. A toll-free telephone "hot line" was the only option dismissed by these respondents.

What sorts of support do teachers in your schools need? (Check any number)

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
Specialists who come to each classroom perhaps once a month	49	35	26	24
Teacher centers where teachers can take their problems	59	32	39	54
Toll-free telephone numbers teachers can call for help	11	11	8	6
A network of fellow teachers willing to help with diagnosis	67	63	50	49

Which of the following do you believe are of substantial help to teachers having problems teaching basic mathematics? (Check any number)

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
University courses in math	17	22	12	14
University courses in math education	41	40	31	41
Staff development featuring presentations by visiting experts	52	24	36	53
Staff development seminars with other teachers talking to a consultant	90	60	40	52
Staff development workshops involving only the teachers	62	53	45	48

Approximately half of the mathematics teachers said that staff development seminars would be useful, whether involving visiting experts, consultants or simply other teachers. Similar proportions of supervisors selected the last two options. Forty percent of each group believed university courses in math education would be helpful but only 22 percent of supervisors and 14 percent of teachers thought the same about university courses in mathematics. Thus it appears that the need is for assistance in methods of teaching mathematical concepts and that both groups are comfortable with the content expertise of mathematics teachers.

As you look at mathematics courses in your school and elsewhere, you probably see things that concern you. Please check those things below that you consider to be major problems. (Check any number)

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
Students have been promoted without knowing basic mathematics	67	59	69	92
Too little emphasis given to the "big ideas" of mathematics	40	29	14	14
Too little attention to the "logic" students use to get wrong answers	63	58	32	34
The curriculum under-emphasizes the basic skills	39	31	49	60
The public and administrators are pushing for the wrong things	19	8	15	17
Too little attention is given the individual student as a person	48	20	32	43
Too little help is available to the teacher with teaching problems	62	25	25	19
Class periods are too short, classes too large	23	25	26	26
Textbooks and workbooks for basic math inadequate for older students	16	8	31	27

A number of possible problems exist in mathematics teaching and both groups were asked to designate those things that they felt to be major problems. Over 90 percent of the teachers said that students are being promoted without knowing the basics and a substantial majority (59%) of supervisors agreed. A large number of supervisors also stated that too little attention is given to the "logic" used by students; a similar proportion of teachers said that the curriculum under-emphasizes basic skills. Neither group indicated that the public and administrators are encouraging the wrong things. Only small percentages selected other possible problems, including inadequate textbooks, although over one-fourth of the teachers identified this as a major problem.

Most seventh grade teachers are disappointed with the skills and knowledge children have when they arrive in September, finding them not ready for seventh grade lessons, needing relearning or even new learnings to get ready. And so with the sixth grade teacher, and the fifth, and so on down. Is this not so?

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
This is the way it is	94	79	55	69
This is not the way it is	13	16	13	9
I don't know	4	6	10	22

Most teachers assume that it is their responsibility to get children ready for the lessons of subsequent years. Is this not true?

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
It is true	88	86	63	88
It is not true	17	9	7	5
I don't know	6	5	7	7

But, examining their own lessons, the projects they assign and the learning experiences their pupils are having, many teachers recognize that they have much broader aims than just getting the youngsters ready for next year's learnings. It distresses them to think of diminishing the broader aims in order to spend more time on the particular skills and knowledge the next teacher may require. Is this not so?

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
That is the way it is	65	69	35	43
That is not the way it is	25	22	26	31
I don't know	14	9	17	26

How do you feel? Should most math teachers reconsider the lessons, the projects, and the experiences in their own class toward the purpose of getting youngsters better prepared for the lessons of the next year?

	K-6 Math Supervisors		7-9 Math Teachers	
	n	%	n	%
Yes, definitely	42	62	39	52
No, the broader aims are important too	50	33	26	31
Other	10	5	11	17

The final items on this scenario deal with the kind of preparation students are receiving. Should the primary emphasis be on preparing students for the lessons of the next year or are there broader aims that teachers see as their responsibility? A majority of both groups agreed that teachers are often disappointed in the skills and knowledge of the children who come to their classes and an even greater number, over 85 percent, thought that teachers feel it is their responsibility to prepare children for the next year.

The groups tended to disagree on whether teachers are distressed by having to choose between this focused preparation and broader aims, 69 percent of supervisors as opposed to 43 percent of teachers. However, a majority of both elementary mathematics supervisors and mathematics teachers reported that math teachers should definitely direct their efforts toward preparing youngsters for the next year with slightly less than one-third of each group replying that the broader aims are also important.

Scenario W: Teaching and Socialization. Some teachers and administrators are concerned about keeping children busy and productive. They may select teaching methods and materials that they feel will promote this type of classroom behavior. Some choose to concentrate on drills and worksheets while others use instructional packages and try to encourage learning by the inquiry method. A scenario was developed to evaluate how elementary school teachers and principals of schools with grades 7 through 9 feel about these related topics. Response rates were 47 of 86 (55%) for the principals and 78 of 150 (52 %) for the elementary teachers.

* * * * * * * * * * *

Please consider this dialogue between two teachers:

Ada James: (cranking the duplicating machine) I don't know what I'd do without the math ditto-masters. They keep everybody busy for the whole period, even John Cohen, who zips through everything in the textbook before I get through explaining it.

Bev Bauer: How do they work? The sheets look pretty simple to me.

Ada James: Well, besides the basic drills, each set includes a few problems that are very difficult, but interesting. Most kids don't get that far. And with these answer cards and the automatic grading machine, I don't get caught having to figure out a problem at the board.

Bev Bauer: Oh, I don't mind that. Someone in the class helps me out. I think it's good for them to see me make a mistake. They know you can't be perfect, and that you have to learn to find the mistake.

Ada James: I made plenty of mistakes when I tried the Inquiry Lessons that Mr. Huang recommended. I didn't mind that as much as the energy it took. It just wore me out. Then it was "textbooks and workbooks" the rest of the day.

Bev Bauer: I know what you mean. For the first time in years we didn't use abacuses this winter. The preparation was just too much. No "hands on" teaching for me this year.

Ada James: Well, I guess I complain about all the work involved, but the real objection is that Inquiry Teaching and projects and science demonstrations let the kids "goof-off." They day-dream or they get off on a tangent or they scuffle. So then I waste more of their time and my time getting them back on the track. I want them to understand that learning is serious business.

* * * * * * * * * * *

Do you find this concern about keeping pupils busy and productive to be typical of how most teachers feel?

	7-9 Principals		Elementary Teachers	
	n	%	n	%
Yes	26	53	52	59
No, they're not concerned	12	36	15	25
No, they're even more concerned	9	11	8	15
Other			1	1

Do you personally consider it a problem when a boy does not work in class even if he does not bother other pupils and even if he does quite well on tests?

	7-9 Principals		Elementary Teachers	
	n	%	n	%
Yes, it's a problem	28	67	51	65
No, that's not a problem	16	29	18	28
Other	3	4	8	7

Combining responses to the first and third options, a substantial majority of principals of grades 7 through 9 and elementary teachers agreed that most teachers are concerned about keeping students busy and productive, 64 percent and 74 percent respectively. Similar proportions considered it a problem even when well-behaved and achieving students are not busy in class. When asked to compare the importance of considerate and respectful behavior in class to understanding subject matter in an open-ended question, (below) over 80 percent of both teachers and principals responded that behavior is of equal or greater importance than content. A slightly lower proportion of principals said that it is more important, 29 percent as compared to 42 percent of the teachers. Not a single comment was made to the effect that behavior is not important or that it is not a teacher function to develop consideration and respect in youngsters.

Please tell how important it is in your school for teachers to insist that youngsters be considerate of others, to show respect to adults, and to follow directions carefully in doing assignments? Would you say it is more important or less important than requiring that pupils understand the subject matter content in their science lesson?

Open-ended responses	7-9 Principals		Elementary Teachers	
	n	%	n	%
Important, more than content	16	29	30	42
Important, less than content	2	1	5	4
Equal importance	26	53	28	42
Other	2	16	14	13

> One teacher said, "If you watch how teachers react in the classroom, you will see them deal first with the belligerent, then with those whose spirits bubble over, then with those who have withdrawn, and only then, with those who are quietly busy but confused." In other words keeping order and getting work started regularly take precedence over improving the quality of the work children are doing. Do you believe that most teachers feel this way?

Open-ended responses	7-9 Principals		Elementary Teachers	
	n	%	n	%
Yes	19	41	27	39
No	13	47	25	34
Some but not most	3	5	8	10
They may not feel this way but they function this way	3	4	1	1
Other	3	2	12	17

Opinion was quite diverse in response to the above open-ended question on the priority order with which teachers deal with children's problems. A surprisingly large number, approximately 40 percent of both groups, said that most teachers agree with the above statement; a slightly larger proportion of principals and an even smaller proportion of teachers disagreed.

> Can social responsibility and social studies be taught at the same time or do they each need pretty much their own time?

	7-9 Principals		Elementary Teachers	
	n	%	n	%
Can teach both at same time	42	94	71	93
Each needs its own time	2	3	6	5
Other	3	3	1	2

There was overwhelming consensus within each of these two respondent groups that social responsibility and social studies are compatible and may be taught at the same time. It is interesting to note that the programming of social studies by various educators almost always attends to the skill and content components and leaves the task of teaching social responsibility to the teacher.

Do you agree with Bev Bauer that it is good for pupils to see teacher mistakes?

	7-9 Principals		Elementary Teachers	
	n	%	n	%
Very definitely	37	90	57	80
No, it is distracting	5	5	4	4
Other	5	5	13	16

What do you believe regarding errors made by teachers, materials and pupils?

	7-9 Principals		Elementary Teachers	
	n	%	n	%
Errors usually should be corrected immediately and authoritatively	8	13	14	18
Usually pupils should be allowed to discover errors; encouraged to discuss them	30	66	48	61
Other	9	21	16	21

Related to the philosophy of discovery or inquiry method of teaching and learning, principals and elementary teachers were asked about making mistakes. Substantial majorities of both groups indicated that it is very good for students to see their teachers make mistakes. Furthermore, there was general agreement, over 60 percent in each group, that students should be allowed to discover errors, whether made by the teacher, themselves or other students or in written materials.

Three additional items were posed to evaluate opinion on the inquiry method, defined as "lessons in which students design and carry out their own investigation." Of the principals, 73 percent reported that less than 25 percent of instruction time is spent on the inquiry method by the average teacher; 54 percent of the elementary teachers agreed. There was a slight tendency for elementary teachers to indicate a higher proportion of time devoted to the inquiry method, but we cannot be sure whether this is due to differences in perceptions between the two groups or because the principals are primarily relating to grades 7 through 9.

Please estimate the percentage of instruction time the average teacher in your school spends in "inquiry teaching," that is, lessons in which students design and carry out their own investigation.

Time spent on inquiry method, continued	7-9 Principals		Elementary Teachers	
	n	%	n	%
Less than 10%	16	18	34	40
10% to 25%	19	55	12	14
25% to 50%	7	10	10	11
More than 50%	2	1	5	12
I don't know	3	16	17	23

Why isn't more time spent in "inquiring teaching" (as defined above)?

	7-9 Principals	Elementary Teachers
	n	n
It is too hard to ask students enough of the right questions	6	12
Students are too likely to "goof-off"	8	18
The necessary equipment and supplies are too difficult to provide	15	32
Most students cannot really carry out inquiries effectively	15	33
Inquiry gives pupils the false impression about what learning is	1	0
Other	15	10

Unfortunately, respondents selected more than one option to the above item and a post hoc analysis on just the actual frequencies of responses is reported. The two most commonly checked reasons by both groups as to why more time is not spent in "inquiry teaching" were that the necessary equipment and supplies are too difficult to provide and that most students cannot really carry out inquiries effectively. Only one principal and no teachers said that inquiry gives pupils the false impression about what learning is.

Is it correct to say that teachers concerned about "getting instruction to happen" usually like "packaged" individualized instruction, such as IPI or Project Plan; but teachers concerned about the subject-matter learned usually do not like such packaged instruction?

	7-9 Principals		Elementary Teachers	
	n	%	n	%
That is correct	18	64	18	22
This is wrong	9	19	10	12
I don't know	17	16	47	65
Other	1	1	1	1

While the majority of principals agreed with the preceding statement that teachers concerned with subject matter generally do not like "package" individualized instruction, a similar percentage of the elementary teachers indicated that they do not know whether or not this is the case. Finally, both groups were asked to comment on the following opinion.

> Please comment on the following opinion. "Among teachers there is not a general acceptance of technology. Worksheet duplication is seldom done by photocopy. Hand-held calculators are owned by many children, but are seen by most teachers as obstacles to learning arithmetic. Instructional television and computer-aided instruction are seldom considered as potentially integral to the school program. The largest barrier is cost, but the profession is generally opposed to technological change." Right or wrong? Please comment:

The majority of both the principal and teacher respondent groups disagreed with this statement: 26 of the 47 principals and 40 of the 78 elementary teachers (16 principals and 30 teachers agreed). They stated that some teachers are opposed to change, but many stated that cost was the major obstacle to trying and accepting new technological developments. There was some indication that training for teachers in the use of technological developments would be helpful.

Scenario X: Teacher Support Systems. The topic of short-term retention of information is used to motivate a discussion of the kinds of opportunities teachers have to obtain help with pedagogic problems. It was our desire to investigate thoroughly the support mechanisms available to teachers, to solicit opinion on which ones are useful, and to ask what assistance they need with this and other teaching problems. The scenario depicting this situation was administered to secondary mathematics supervisors of grades 7 through 12 and science teachers of grades 7 through 9. Of the supervisors 132 of 211 (63%) responded as did 93 of 150 (62%) science teachers.

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Please consider this situation:

Teachers at Cyrus Knight Junior High School have more than a few puzzlements about persisting instructional problems. They do not have much time to think about them. Each teacher does have some free moments--but then it seems there is no one to talk about it to. The conversation in the teachers' lounge is usually about social things--movies, sports, camping trips, and school politics. The principal is always willing to help, if it's an organization or scheduling problem, but has little more than a sympathetic ear for something like the "forgetting problem."

Teachers aren't surprised that youngsters forget their lunch money or that they forget the name of the prime minister of Canada. But they cannot understand how children who last month completely knew how to divide 404.13 by 37, or who knew exactly the three requirements for combustion, now cannot even come up with a partial answer.

There is an "inservice program." Almost every month district resource persons of some kind come after school to give a demonstration or to get a discussion going but the real problems of teaching seem to be a mystery to them too. Inservice people bring plans for keeping student-performance check-lists or new procedures for organizing laboratory projects, but not much on pedagogic problem-solving.

About half the teachers are enrolled in an evening or summer school course. Once in a while they have an opportunity to bring up something like the forgetting problem. It becomes apparent that it is a common problem with others in the course. The instructor may help to analyze the problem, speaking perhaps of "identical elements" and "retroactive inhibition." But it is not much help.

There may be no answers to problems like these. For the teachers at Cyrus Knight, there are few opportunities to find out. They have less than a half dozen chances a year to explore such problems. There is even some expectation that most of the time such problems should not be talked about.

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How similar is this picture to the situation in the junior high school(s) or middle school(s) in your district?

	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
Quite similar	63	51	56	60
Not very similar at all	39	39	24	27
Other	15	10	13	14

In your opinion are middle schools or junior high schools better organized to help teachers with such problems?

	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
Middle schools	24	13	14	19
Junior high schools	13	7	6	10
No difference	43	53	29	23
Don't know	43	27	42	47

Over 50 percent of both secondary mathematics supervisors and middle/junior high school science teachers agreed that the situation depicted in the scenario is similar to that at their own schools. Medium-sized proportions, however, said that this situation is not like their own. When queried on whether middle or junior high schols could best cope with these kinds of problems, of those in both groups who saw a difference, there was a slight indication that middle schools are better organized to deal with such problems.

What in this description of Cyrus Knight School is particularly relevant to the schools in which you work?

Response trends among both secondary mathematics supervisors and science teachers of grades 7 through 9 were similar. The most commonly mentioned point of relevance was lack of time to think about or discuss problems. The next two aspects most frequently noted were that the forgetting problem is a real one and that inservice programs do not deal with or solve such problems. Other responses were that nothing and all or almost all of the description was relevant to their own situations, an almost equal split. The final substantial response was a comment that the lounge converstaion sounded familiar.

What important differences are there between your situation and that of the Cyrus Knight School?

The responses here differed somewhat between the two respondent groups. The major difference mentioned by supervisors was that their schools do not have good inservice programs while none of the teachers mentioned this. In fact, the teachers' third most frequent response was that they have either no inservice program or a very limited one. The supervisors also said that teachers do have time and opportunity to discuss and work on such problems; they do not have resource persons visiting regularly; the principal is responsive to such problems; and teachers are involved in suggesting and planning inservice programs. No difference between situations was their fourth most frequent response. The difference most commonly mentioned by teachers was that they have or make time to discuss and plan with one another to deal with such problems at their schools. Almost as frequent was the comment that there was no difference, followed by the previously mentioned comment regarding the lack of inservice programs. They also said that their principals are responsive to such problems and they do not have resource persons available or visiting regularly.

By and large, how would you describe the climate for solving pedagogic problems in schools where you work?

	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
The climate is good	88	77	47	50
Conditions prevent a good climate	34	20	28	29
Nobody cares	3	1	15	21
Other	4	1	0	0

Would you say that teachers are able to take good advantage of the experience of other teachers for solving their own teaching problems?

Teachers assisting each other, continued	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
Yes	80	65	60	63
No	37	23	24	26
I don't know	6	7	9	11
Other	8	5	0	0

Substantially more supervisors than teachers stated that the climate at their school(s) is good for solving pedagogic problems, 77 as opposed to 50 percent. Perhaps of even greater concern is the fact that 21 percent of the science teachers, a proportion significantly greater than zero, said that nobody cares. Both groups agreed quite closely, however, that teachers are able to help one another with such problems. The small number who answered "no" to this last question were asked to indicate why they are unable to do so; most gave more than one reason and only raw frequencies are presented. The most popular reasons were a lack of time to work on such things, little reward to teachers for helping each other and talking about such problems is threatening and an admission of weakness.

If you answered "no" why do you feel that they are unable to do so?

	7-12 Math Supervisors	7-9 Science Teachers
	n	n
Teaching problems are idiosyncratic, the same solution doesn't work elsewhere	10	7
Talking about teacher problems is threatening, an admission of weakness	20	8
There is no time to work on these things	26	14
The emphasis on teacher assessment discourages discussion of problems	5	3
Little reward is given to teachers for helping each other	21	11
Other	2	1

In training and selecting principals do you believe that too much emphasis has been placed on their ability to organize and administer the school program and not enough on understanding pedagogic problems?

	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
Yes	70	40	50	47
No	24	42	17	12
I don't know	32	18	26	41
Other	2	0		

A sizable proportion of both mathematics supervisors and science teachers, 40 and 47 percent respectively, responded that principals have been trained or selected on the basis of administrative as opposed to educational skills. However, a smaller proportion of supervisors said this is not true while a significantly lower proportion of teachers, only 12 percent, selected this response.

> What is your feeling about summer institutes such as NSF has sponsored? (These are institutes involving fulltime enrollment in special sections of college math or science courses, with some help from educational professors.) Check one or more.

	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
They do a good job of giving ideas, contacts, and confidence	86	54	49	53
They are good for good teachers, not very helpful for teachers really needing help	25	25	10	15
They are not as valuable as institutes run by experienced teachers	18	13	9	9
There should be more of them so that all teachers needing them could enroll	66	37	42	52
Other	25	12	25	24

A slight majority of both groups indicated that the NSF summer institutes are useful in providing teachers with ideas, contacts and confidence. Additionally, a similar proportion of science teachers said that there should be more institutes. They apparently feel that these activities are more useful than institutes run by experienced teachers. Under "other" both groups commented that they do not know what NSF institutes are like. Several other comments and suggestions were made, each mentioned only once. Some of the teachers did mention that they had attended such institutes and found them very helpful, great, "the most fantastic experience and help I've had as a teacher."

> One Cyrus Knight teacher said, "Schools and universities are headed in different directions. Schools want more and more to teach what parents and students believe is useful. Universities want to stress theoretical ideas, the search for Truth." Is this a problem?

	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
No	36	18	35	30
It causes some problems, but that is just the way things are	24	27	14	29

Directions of schools and universities, continued	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
Yes, a problem, mainly because schools no longer see what education is	15	29	11	12
Yes, a problem, mainly because universities just are not interested in people	9	9	9	13
Other	44	17	23	16

Both supervisors and teacher groups were fairly evenly distributed in their response to the potential conflict between the educational goals of schools and universities. Other comments included a real variety of opinion. While a few teacher and supervisor respondents agreed that schools and universities are headed in different directions, they said the curriculum should respond to both. Some people disagreed with the statement. Several comments from both groups indicated a feeling the universities are out of touch with the schools and with practical aspects of teaching.

What could universities do to be of most help to teachers? (Check only one)

	7-12 Math Supervisors		7-9 Science Teachers	
	n	%	n	%
Develop curricula more appropriate to the times	21	23	26	43
Run inservice workshops and institutes	27	13	16	16
Offer courses oriented to teacher needs	26	27	15	12
Establish teacher centers	4	0	5	3
Sponsor teacher networks for mutual help	6	3	6	6
Other	44	33	23	20

When asked what universities could do to help teachers, the largest proportion of science teachers selected the development of more timely curricula. Approximately one-fourth of the supervisors selected this option along with offering courses oriented to teacher needs. There was negligible support from either group to establish teacher centers or sponsor teacher networks for mutual help. It is impossible to know whether the low response to these suggestions is because they are truly unattractive or if, perhaps, the idea of such centers and networks is too abstract. Under other suggestions, comments included very little from the teachers other than offering courses dealing with the actual classroom situation, methods and discipline. Supervisors suggested these as well as courses in reading, math, science and social studies; identifying and meeting the needs of individuals within the classroom and working with underachievers and "reluctant learners." The few other comments were scattered except for a small cluster around improved teacher training with more stress on the subject matter and education faculty spending time in K through 12 classrooms.

Finally, respondents to this scenario were asked to respond to an open ended question asking what they feel is most needed to improve opportunities for teachers to get help with pedagogic problems in their classroom. Many suggestions were made by both groups with four major areas of possible improvement. The first was more time (and support for time) devoted to planning and preparation and sharing ideas with other teachers. The second major recommendation was for constructive supervision by experienced, master teachers and the opportunity for consultation with such people; for workshops and inservice programs cooperatively planned by university, central office and school staffs with a goal of solving such pedagogical problems. A third emphasis included improved teacher training that is more relevant to actual situations, longer internships or experiences in schools, and maintaining high standards for certification. The final major suggestion was that there be more communication between administrators and teachers leading to greater understanding and support from the administrators; greater understanding and support from parents and the public were seen also as desirable.

Scenario Y: Personal Bias in Teaching. The National Science Foundation has been explicit in including social studies or sciences along with mathematics and science in its definition of science education. This definition provided the opportunity to investigate two issues that are of special interest in the social sciences. First, it was desirable to investigate how the scientific method of inquiry is perceived as applied to social studies and the prevalence of its use. Second, perhaps more than the other two disciplines, social studies include topics of potential controversy and possibly are more prone to contamination by personal bias.

A conversation between the teacher and students in a American history classroom is the setting for this scenario. Four groups were asked to respond to the scenario: social studies teachers in grades 7 through 9, social studies teachers in grades 10 through 12, high school seniors and parents of high school seniors. Response rates were 42 of 75 (56%) of grades 7 through 9 teachers, 41 of 75 (55%) of grades 10 through 12 teachers, 361 students and 148 of approximately 250 (~59%) parents. The possibility of combining the two groups of social studies teachers was considered. However, their responses were quite consistent except for slight differences on two items and it was felt that demonstration of this consistency to the reader was worthwhile. Thus the two groups have been analyzed separately, in spite of the small individual sample sizes.

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Please consider the following situation:

At Metro High School, Mr. Robinson's American History class is studying immigration and the settlement of America, noting particularly how immigrants have influenced the growth of their city. Here is dialogue midway through Monday's class:

Mr. Robinson: After the Irish immigration of the 1840's and after the importation of Chinese laborers, what other waves of immigration occurred? Sally?

Sally: Europeans around 1890 and then again after World War I.

Mr. Robinson: Good. I guess that's when we got our Polish jokes, right? (no one laughs) Well, let's see. What sort of long-time trend are we studying?

Sherman: People coming to America.

Mr. Robinson: Why did they come, Tammie?

Tammie: To come to a country with freedom.

Doug: (sarcastically) Like freedom to pick cotton.

Mr. Robinson: Well, let's think about that. Some of the early colonists were seeking freedom. Were the Chinese who came after the Civil War seeking freedom? (no answer) What were they looking for? (no answer) What were the Irish looking for?

Wendy: Food!

Mr. Robinson: Food more than freedom? Let's make a list of possible reasons for immigrating, then consider each one.

Eric: My dad says we should be studying how to send them back where they came from rather than how they got here.

Mr. Robinson: Okay, that's an idea. After we make our list of reasons for immigration, let's figure out who wanted the immigrants here and who didn't want them. And then let's decide whether I should be sent back to Africa or Europe.

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Mr. Robinson is asking questions about history and joking about it. What is your reaction to his teaching style?

	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
It is fine for some teachers to teach this way. It gets their attention	27	51	22	54	186	61 (52)	87	41 (60)
I find it offensive	3	22	3	16	26	9 (7)	20	19 (14)
I don't mind, but he is not likely to get the job done	5	16	7	12	70	18 (19)	27	28 (19)
Other (fine in principle but not in this case)	7	12	1	2	71	11 (20)	11	12 (8)
Other (please indicate)	0	0	8	16	7	1 (2)	1	0 (1)

A majority of all the groups except parents agreed that the approach used by the teacher in this scenario is acceptable; this latter group had the highest proportion saying that, although acceptable, the approach is likely to be ineffective. Many of the comments made under the "Other" category stated that this approach is fine in principle, but not in this particular illustration; thus this category was added in reporting responses on this item.

Do teachers and students talk like this in your school(s)?

	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
Yes, lots do	8	11	9	31	55	14 (15)	34	21 (24)
Yes, a few do	26	55	24	46	261	56 (72)	83	32 (59)
No	6	28	7	22	44	30 (12)	14	43 (10)
Other	2	6	1	1	1	0 (0)	10	3 (7)

Over half of all groups reported that teachers and students interact in this manner in their school(s), the highest being 77 percent of the high school social studies teachers. A slightly higher proportion of parents did not agree that this somewhat breezy approach to teaching social studies occurs in their schools.

Mr. Robinson seems reluctant to accept the idea that most immigrants came to America seeking freedom. Let us suppose that this is a bias of his. How important is it for social studies teachers to keep their biases to themselves?

	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
They should recognize their biases and keep them to themselves	9	15	5	16	44	11 (12)	40	24 (27)
They should speak honestly as to how they feel on matters	1	2	1	2	31	7 (9)	6	1 (4)
They should tell how they feel, but present alternative views too	26	72	25	59	254	78 (71)	94	72 (64)
Other	6	1	10	23	30	4 (8)	6	3 (4)

Suppose Mr. Robinson was leading up to a critical analysis of the free enterprise system. Suppose he intended to say that the system was dishonest, that it was cruel in the way it imported cheap labor from foreign lands to work in this country. Do you feel that it would be inappropriate for Mr. Robinson to acquaint the students with his conclusions about the free enterprise system in early America?

	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
It would be right, in fact it is his responsibility to be frank	6	9	1	1	55	15 (16)	32	11 (22)
It would be all right as long as he indicated his value-orientation	24	61	30	75	165	41 (47)	72	46 (49)
It is ethically proper, but he would be foolish to do so	3	6	0	0	16	8 (5)	6	14 (4)
It is wrong for him to use his position for teaching those things	6	16	3	5	65	19 (18)	28	23 (19)
Other (please explain)	3	8	7	20	53	17 (15)	9	5 (6)

The previous two items deal with bias or personal opinion of the teacher and asked respondents how this should be handled in the classroom. A majority of all groups agreed that teachers should speak honestly but also present alternate views. Students were in strongest agreement, 85 percent; over 70 percent of parents and social studies teachers of grades 7 through 9 agreed while slightly less, 61 percent, of those teaching grades 10 through 12 concurred.

On the second item, a similar proportion of 7 through 9 teachers agreed that it would be right for Mr. Robinson to be frank or indicate his value-orientation. The proportion of teachers of grades 10 through 12 increased to 76 percent in their approval of this approach while proportions dropped for parents and students, a drop of 27 percentage points for the latter. Thus, in spite of the slight shifts in approval between the responses to the two items, we may conclude that a majority of these groups agreed that teachers should be frank and present their own views on controversial topics. Yet the case study field workers found teachers frank but seldom dealing with controversial issues, and then usually to present only the prevalent views of the community.

Some parents believe that certain topics should be left out of science and social studies courses, topics such as evolution of the species, human reproduction, and family attitudes and customs. Some parents want such things taught, and of course, want them taught well. --- We need to find out how you feel about using Federal Funds for development of teaching materials that include such controversial topics.

	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
Federal funds should never be spent on such development	5	13	3	9	18	21 (5)	35	33 (24)
It is all right to spend federal funds this way if it will not cause trouble	4	7	7	10	98	22 (28)	27	12 (18)
It is important to provide federal support for such development	25	58	20	59	196	46 (55)	63	29 (43)
Other	8	21	10	22	42	11 (12)	22	27 (15)

The above item was designed to assess how respondents feel about the use of federal monies to support the development of potentially controversial subject matter. A majority of social studies teachers in both groups as well as students tended to approve the use of federal funds for this purpose while quite small proportions, none significantly greater than zero, said such funds should never be used to develop teaching materials on controversial subjects. Parents, on the other hand, were more undecided about the use of federal funds for this purpose. Twenty-nine percent indicated it is important while 33 percent disagreed with this use of federal monies; both proportions are significantly greater than zero.

In what ways have budget cuts in your district seriously affected the social studies curriculum? (Check one or more)

	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
We have not had budget cuts recently	11	42	10	29	67	23 (19)	34	20 (23)
The social studies curriculum has not been seriously affected in any way	10	14	12	24	105	26 (29)	41	22 (28)
Classes have been larger in size	15	31	12	30	76	14 (21)	29	20 (20)

Effects of budget cuts, continued	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
Needed and highly qualified teachers have been "let go" and not replaced	2	3	5	11	36	7 (10)	17	19 (12)
We have more teaching from textbooks, less with materials or in the field	14	27	10	22	107	27 (30)	29	31 (20)
No longer can we provide a textbook for each student individually	5	14	3	6	27	9 (8)	7	2 (5)
The inservice training program has been cut back substantially	4	7	5	14	12	2 (3)	2	1 (1)
Other (please indicate)	6	12	3	5	32	11 (9)	18	6 (12)

Overall, approximately one-fourth of the respondents reported that they have not had recent budget cuts in their district and a slightly smaller proportion stated that, if one has occurred, it has not seriously affected the social studies curriculum. Over 30 percent of the teachers, however, said that classes have been made larger. Approximately one-fourth of each group indicated there is more textbook teaching and less work with materials or in the field. The other options were selected by only small proportions of any respondent group.

The final item in this scenario asked these people to indicate any major problems with the social studies courses. No option was selected by a majority of any group, perhaps indicating a general satisfaction with the social studies curriculum. Not enough qualified teachers was noted by 47 percent of the parents but by smaller proportions of the teachers themselves. There was some agreement, except among parents, that courses emphasize facts too much and concepts not enough. Small but very consistent proportions indicated a desire for more emphasis on the teaching about personal values.

> As you look at social studies courses in your high school and elsewhere, you probably see things that concern you. Please check those things that you consider to be major problems. (Check as many as you wish)

	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
Too much emphasis on facts, not enough on concepts	18	36	13	27	168	40 (47)	32	14 (22)

Problems with social studies, continued	7-9 Soc Stud Teachers		10-12 Soc Stud Teachers		Students		Parents	
	n	%	n	%	n	%	n	%
Too much emphasis on concepts, not enough on facts	8	16	11	26	47	13 (13)	33	39 (22)
Too much emphasis on teaching about personal values	4	8	2	4	43	8 (12)	14	5 (10)
Not enough emphasis on teaching about personal values	12	24	13	27	122	35 (34)	49	36 (33)
Not enough qualified teachers	7	16	5	21	75	23 (21)	48	47 (32)
Belief that teachers teaching the same course should teach the same things	9	17	10	16	104	17 (29)	22	16 (15)

Scenario Z: Elitism in Science. Science courses have frequently been thought of as courses for the "brighter" students, especially such courses as chemistry, physics and the advanced mathematics courses. Of course, all students must take some basic courses such as general science and/or biology, general math or some equivalent. There is an attempt by many teachers to make science relevant and a realization that science knowledge is required to live in today's society, but there is still evidence of the old "elitism" regarding advanced courses. A scenario depicting a conversation among students was developed to gather reactions from high school counselors, science teachers of grades 10 through 12 and senior students in order to determine the prevalence of these ideas. Response rates were 46 of 87 (53%) 101 of 150 (67%) and 375 students.

Four ninth grade biology students waiting for the afternoon bus:

Ann: Sure it would be fun to be doing something, but lots of kids don't want to dissect frogs.

John: Ridiculous!

Laurie: I can't stand killing insects and pinching them to a board.

Tania: Next week we're going to watch plants grow. What do we do while we wait?

Laurie: Probably bookwork.

Tania: More hassles! There's not enough time to study at school. And they won't let you check the books out, so I can't study at home. So I flunk. Biology is too hard. It should be at the tenth grade.

John: There should be better "filtration." Not everybody should be allowed in the course. If you're going to take biology you gotta be willing to work.

Ann: That's what Mr. Mueller says. He says when we get to physics we will really have a good class because only the best students will be there.

Tania: But that's why it's so hard. My courses are too hard already. The kids who don't want to study have already gone into Art and Psychology.

John: Dumbhead courses!

Laurie: In seventh grade all the kids are mixed together in a big group, and then it splits--like that "mitosis" stuff, y' know.

Tania: Well, I want to be an obstetrician. I'd like to study birth and everything and sex education. You know, films and that sort of thing. Just reading from a book you don't get enough information. They use all those humungus words, all that Latin! Yuk!

* * * * * * * * * * *

Are the feelings expressed here typical of opinions held by students in your first-year biology classes?

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Yes	18	60 (43)	59	61	231	61 (65)
No	20	37 (48)	29	37	126	39 (35)
Other	3	4 (10)	5	2	0	0

Approximately 60 percent of each group agreed that the feelings expressed by the students in the scenario are representative of first-year biology pupils. Slightly over 35 percent disagreed. When asked why they disagreed, all three groups of respondents commented that students have a more positive attitude, both in general and toward science courses, and that students are not all afraid of hard courses. It was also noted that biology is not always taught in the ninth grade. Students also mentioned that art and, especially, psychology are not viewed as "dumbhead courses" and that books are not as inaccessible as depicted in the above conversation.

What do you think is the principal cause of student dissatisfaction such as this? (Check one)

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Boring lessons	5	10 (13)	5	6	83	24 (31)
Insensitive teachers	5	5 (13)	6	5	8	1 (3)
Incompetent teachers	5	6 (13)	2	5	16	3 (6)
Their own immaturity	11	45 (28)	24	32	49	23 (19)
Subject matter is irrelevant to student lives	8	23 (21)	12	15	55	28 (21)

Causes of student dissatisfaction, continued	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Unrealistic assignments	2	7 (5)	3	3	17	4 (6)
Inadequate textbooks	0	0	0	0	8	3 (3)
Inadequate lab equipment and supplies	3	4 (7)	2	2	13	10 (5)
It's just talk, they aren't really distressed	0	0	7	32	15	3 (6)
No comment	7	0	40	0	111	0

When asked the principal cause of student dissatisfaction with science courses; over 60 percent of the counselors said it is due to student immaturity on the irrelevance of the subject matter. High school science teachers, on the other hand, tended to select student immaturity and the belief that students are not really distressed - that it is just talk, although the latter reaction is based upon a small number of respondents. One-fourth of the students themselves said they are dissatisfied because the lessons are boring and the subject matter is irrelevant, and a similar proportion indicated it is due to their own immaturity.

An open ended question asked those people if there are some important changes that could be made in science courses so that such students would like them more and get more out of them, and, if so, what changes. The suggestion mentioned most frequently by all three groups was that courses should be made more practical and relevant. The next most frequent recommendation was to have more lab experience and activity, cutting down on bookwork. Better teaching, a greater variety of elective course offerings, smaller classes and more individual attention along with more improved materials and up-to-date textbooks were mentioned by all three groups. Students further stressed the importance of the teacher in stimulating interest and learning. Several also suggested making science courses more interesting without any specific criteria or guidelines for doing so.

Are science courses in your school too difficult?

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Yes	7	11 (15)	9	9	47	12 (13)
No	33	84 (72)	87	88	272	81 (73)
Other	6	5 (13)	3	3	53	7 (14)

In science courses in your school, is the balance between lab or project and textbook work about right?

Balance between lab and bookwork, continued	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Yes	23	25 (50)	65	69	205	69 (56)
No, we need more lab work and projects	22	74 (48)	34	30	153	29 (41)
No, we need more textbook work	0	0 (2)	0	0	11	1 (3)

Do you feel your school should be offering more science courses designed for the "below average" student?

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Yes	20	43 (47)	50	44	167	26 (45)
No	22	54 (51)	46	52	125	46 (34)
I don't know	1	1 (2)	4	3	80	28 (22)

Is it more difficult for students to get good grades in science than in most other subjects in your school?

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Yes	17	31 (37)	36	33	140	35 (38)
No	28	68 (61)	51	43	167	47 (45)
I don't know	1	1 (2)	12	18	64	17 (17)

The above four items asked about science in the respondent's own school. Overwhelming majorities of all groups stated that science courses are not too difficult and almost 70 percent of teachers and students said the balance between lab or project and textbook work is acceptable. Surprisingly, a large proportion of counselors (even disregarding the weighted percentages) disagreed with teachers and students on this latter question with three-fourths saying more lab and project work is needed. No counselors or teachers and a negligible number of students indicated a need for more textbook work.

Counselors and teachers were about evenly split between whether or not more science courses should be offered for "below average" students; only one-fourth of the students agreed that this should be the case. On the subject of the ease with which students can get good grades in science, approximately one-third of each group responded "yes." Slightly larger proportions of teachers and students, 47 percent, disagreed that it is more difficult to get good grades in science as opposed to other courses. However, many more counselors (68%) stated that this was true at their school.

Do you believe that a major effort should be made to raise the "scientific literacy" of young adults?

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Yes	35	87 (76)	97	96	228	57 (61)
No	5	3 (11)	4	5	68	10 (18)
I don't know	5	6 (11)	0	0	75	33 (20)
Other	1	2 (2)	0	0	1	0 (0)

Should school districts set some minimum competency in science for all students to obtain in order to graduate from high school?

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Yes	28	46 (61)	70	71	189	49 (51)
No	11	46 (24)	16	20	137	39 (37)
I don't know	5	7 (11)	15	9	45	13 (12)
Other	2	2 (4)	0	0	1	0 (0)

Are junior and senior science courses in your school aimed primarily at the students who will be going to college?

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Yes	34	76 (74)	72	78	273	73 (73)
No	9	21 (20)	27	18	54	11 (15)
I don't know	0	0 (0)	1	3	45	16 (12)
Other	3	3 (7)	1	1	1	0 (0)

Three items were designed to obtain opinion regarding some current issues in science education. Almost all teachers and 87 percent of the counselors stated that there should be a major effort to increase "scientific literacy" among youngsters. Over half of the students agreed, but one-third said they do not know; perhaps they do not know what is meant by this phrase. On the question of minimum competency in science as a pre-requisite for high school graduation, 71 percent of the high school science teachers supported this proposal. Counselors and students were more evenly divided on the question. This identical item was included on one of the versions of the questionnaire fourth page. In response to that question, 67 percent of a combined teacher group agreed, as did 46 percent of the students, indicating consistency in the response to this proposal. Finally, there was general agreement among the three groups, over 70 percent in each case, that junior and senior level science courses are primarily designed for students who will attend college.

Do science teachers in your school seem to want mostly to teach "pure" science rather than about how science is used in everyday life?

	Counselors			10-12 Science Teachers		Students		
	n	%		n	%	n	%	
Yes	17	22	(38)	34	29	179	43	(48)
No	19	37	(42)	52	49	127	35	(34)
I don't know	5	36	(11)	13	22	59	22	(16)
Other	4	5	(9)	1	0	5	1	(1)

The relevance of science courses was examined in the above item. More counselors and teachers, 37 and 49 percent, respectively, said that teachers in their schools do not prefer to teach "pure" as opposed to applied science. Moderate percentages did, however, indicate an emphasis on "pure" science. The response to this item constitutes the strongest evidence of elitism in high school science that was observed; however, no comments indicated that the emphasis on "pure" science was seen as harmful.

Do school counselors discourage students from taking science electives?

	Counselors			10-12 Science Teachers		Students		
	n	%		n	%	n	%	
Yes	1	1	(2)	12	17	12	2	(3)
No	43	97	(94)	70	69	286	83	(78)
I don't know	0	0	(0)	17	13	70	15	(19)
Other	2	2	(4)	1	0	1	0	(0)

If you answered "yes," why do counselors do this? (Check as many as you wish)

	10-12 Science Teachers	Students
	n	n
They encourage students to keep their Grade Point Average high	11	7
They do feel science has little to do with getting a job	5	4
They are opposed to anything that is "academic"	0	3
They feel the science teachers prefer small, bright classes	4	6
They are sympathetic to kids who feel that science classes aren't relevant	10	7
Other (please specify)	4	6

There appeared to be substantial agreement that counselors do not discourage students from taking science electives although significantly larger proportions of counselors than teachers said this is so. Of the teachers and students who indicated that counselors do discourage students, the major reasons appeared to be due to the necessity to maintain high grade point averages and sympathy with students who feel science courses are irrelevant.

> As you look at science courses in your high school and elsewhere, you probably see things that concern you. Please check those things that you consider to be major problems. (Check as many as you wish)

	Counselors		10-12 Science Teachers		Students	
	n	%	n	%	n	%
Too much time must be spent on remedial mathematics	11	29 (24)	45	63	68	19 (18)
Too much time must be spent on teaching reading	11	15 (24)	37	48	62	11 (17)
Too little attention is given to individual students	16	20 (35)	39	34	189	36 (50)
Too little help is available to the teacher with teaching problems	13	20 (28)	34	41	96	21 (26)
Class periods are too short, classes too large	12	16 (26)	48	62	114	22 (30)
Lab facilities or field arrangements are inadequate	20	73 (44)	49	51	118	34 (32)
The public and administrators are pushing for the wrong things	3	6 (7)	32	45	85	20 (23)
Other	12	25 (26)	17	19	44	23 (12)

The final item on this scenario asked respondents to indicate any major problems with science courses. A large proportion of counselors, 73 percent, said that lab facilities or field arrangements are inadequate, although fewer teachers (51%) and students (34%) agreed. Teachers indicated that too much time is spent on remedial mathematics (63%) and on teaching reading (48%). They also said class periods are too short and classes too large (62%). Over 40 percent would like more help for teachers with teaching problems and 45 percent stated that the public and administrators are pushing for the wrong things. It is important to note the high level of distress on all these items evidenced by the science teachers. Interestingly, fewer students identified major problems with science courses, with one-third indicating that too little attention is given to individual students and a similar proportion agreeing with the previous comment on lab facilities.

RESPONSES TO SCIENCE EDUCATION GENERAL QUESTIONS

The last page of the four page questionnaire was designed to contain items that were of broad interest to all respondent samples. The distinct fourth pages were constructed, each was printed on one-third of the questionnaires, and they were randomly administered to respondents from each group. This procedure permits the assessment of larger samples on selected issues of wide-reaching concern. A copy of each of the fourth page formats is included as an appendix to this chapter.

Samples have been combined in order to analyze these questions. Superintendents and principals from all three grade levels are combined as an administrator group. Supervisors have been combined, as have teachers, disregarding discipline specialty and grade level. Parents and students constitute the last two groups. Counselors responses have been omitted from these groupings. Standard errors may be interpreted from Tables 18-1 and 18-2 in the same manner as previously noted. Unweighted percentages are in parentheses for students and parents.

Response rates for the combined groups are as follows: 234 of 416 administrators (56%), 674 of 1020 supervisors (66%), 530 of 900 teachers (59%), 401 of approximately 736 parents (55%) and 736 students.

Page Four, Format 1: Questions on Public Schools: The first of the three pages of general questions was administered at random to approximately one-third of each group and was responded to by 76 administrators, 228 supervisors, 173 teachers, 126 parents and 245 students for a total sample of 848 persons. The first item asked respondents to identify the biggest problems with which the public schools in their community deal. The most common responses have been tallied and are presented below with the raw frequencies of responses. Up to two responses per person are included in the tally.

What do you think are the biggest problems with which the PUBLIC schools in this community must deal?

Comments	Administrators	Supervisors	Teachers	Students	Parents
	n	n	n	n	n
Budget problems, priorities, tax base	19	46	37	33	18
Student apathy, motivation, absenteeism	7	19	20	39	13
Community apathy, support	9	26	19	6	5
Student discipline	3	7	16	16	19
Teaching quality	2	6	2	19	10
Parental apathy, support	7	14	19	2	4
Curriculum methods	0	17	10	10	7
Racial problems, integration, busing	3	4	3	16	10

The comments on the above free response item were content analyzed after return of the questionnaires; the most commonly mentioned problem was budget problems and priorities and dissatisfaction with the tax base. This problem was the most popular complaint by all the school professionals: administrators, supervisors and teachers. The second most frequently cited problem overall was student apathy, lack of motivation and absenteeism. Students recorded this problem more often than any other and it was the second most popular response from teachers. School personnel were especially concerned with community apathy and lack of support, ranking as the second most common problem by administrators and supervisors, and with parental apathy and lack of support. Supervisors and teachers additionally expressed concern over curriculum methods.

Three issues especially noted by students and parents were general problems with student discipline, the most commonly cited problem by parents; the overall quality of teaching; and problems with integration and busing. Other problems listed with some frequency were lack of respect by students, permissiveness, moral state and values, ranked ninth overall; large classes and over-crowding, listed third by students and tied for tenth and eleventh overall along with the wide range of student interests and needs to be met. Finally, listed twelfth overall and sixth by supervisors was concern with lack of basic skills on the part of students.

Our findings are in general agreement with those of the Ninth Annual Gallup Poll.* Of the eight top problems listed by 1506 adults in that poll, six were among the eight most frequently cited by our respondents. Lack of discipline was number one on the Gallup Poll and number four in our survey. Budget problems, listed most frequently by our respondents, was rated the third largest problem in the Gallup Poll. The two problems in the top eight identified by Gallup and omitted by our respondents were use of drugs (rated sixth) and size of school/classes (rated eighth), although this latter problem was listed fourth by students. Two problems identified in our survey that were not among the top eight in the Gallup Poll were student apathy and community apathy.

> Some of our contemporary social problems are: Health care, poverty, abortion, discrimination, and graft. Some people want the social studies to be taught so that pupils learn how to analyze these problems. Some people want the schools to avoid discussion of offensive social problems. How do you feel?

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*George H. Gallup, "The Ninth Annual Gallup Poll of the Public's Attitudes Toward the Public Schools," Phi Delta Kappan (September 1977): 33-47.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Elementary school pupils should learn to analyze such problems	39	61	102	57	68	58	63	27 (27)	48	33 (39)
Pupils should be made aware of the problems but "problem analysis" is not a suitable goal for the elementary school social studies program	24	31	67	30	66	33	122	44 (53)	44	27 (36)
Contemporary social problems are not suitable topics for the grade school	4	2	9	5	12	3	25	18 (11)	17	21 (14)
Other	8	7	41	9	18	6	20	11 (9)	15	9 (12)

Scenario Y on Personal Bias in Teaching attempted to discover what a group of parents, students and social studies teachers think about a teacher sharing his or her own personal views in the context of a classroom discussion. The above question was designed for the general purpose of eliciting opinion on the acceptability of teaching including controversial contemporary problems in elementary schools. Approximately 60 percent of administrators, supervisors and teachers tended to agree that elementary school students should learn to analyze such problems while only about 30 percent of seniors and parents felt this way. Thirty percent of school personnel said that elementary students should be made aware of such problems but that "problem analysis" is not a goal for these grade levels. Very small percentages selected the third option that contemporary social problems are not suitable topics for the grade schools. Over 40 percent of the students and one-fourth of the parents said that pupils should be made aware of the problems but about 20 percent of these groups felt that these problems are not suitable for grade school.

Should all high school students in the United States be required to pass a standard examination in order to get a high school diploma?

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Yes, they should	30	42	99	56	104	66	105	54 (44)	78	69 (63)
No, they should not	32	40	88	36	42	19	108	33 (45)	40	27 (32)
I don't know	12	17	32	8	26	15	28	14 (12)	6	3 (5)

Should school districts require some minimum competency level in science for all students to attain in order to graduate from high school?

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Yes, they should	37	37	121	70	105	67	108	46 (46)	73	67 (59)
No, they should not	26	37	76	23	37	17	100	40 (42)	42	31 (34)
I don't know	10	26	26	8	28	16	28	14 (12)	8	2 (7)

The subject of minimum competencies was investigated in the next two items. Six states have already passed legislation requiring minimum competency for high school graduate while the subject is under serious consideration in another 12 states. In addition, in 10 states the requirements have been changed by the state board of education. In a recent survey in Georgia, Schab found that the following percentages agreed with the requirements of twelfth grade competencies in reading, writing, listening, speaking and arithmetic skill: students (43%), parents (60%), teachers (31%), and administrators (13%, although a larger proportion, 32% agreed with requiring eighth grade competencies).*

Our results indicated a generally higher level of acceptance of minimum competency requirements although it must be noted that the above items are not as specific in the level of required competency as was the question posed by Schab. Parents were the group in highest agreement (69%) with administrators being the most opposed (42%).** It might have been anticipated that a smaller response rate would be obtained when asked if minimum competencies in science should be required, but this was not the case, except for small but not significant decreases for administrators, students and parents. Of special interest is the 14 percent increase in agreement by supervisors. On both questions, larger proportions of administrators said they are undecided.

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*Schab, Fred, "Who Wants What Minimal Competencies?" Phi Delta Kappan 59 (January, 1978): 350-52.

**The response from administrators was not entirely consistent with field observations that many administrators were seeking to establish technical requirements for better management of the schools. See Chapter 17.

What are the major criticisms of the textbooks that are being used in your school? (Check as many as you wish)

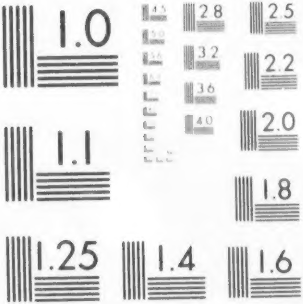
	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Out-of-date	16	10	43	13	27	17	131	42 (54)	35	30 (28)
Simplistic	6	11	14	5	17	3	16	3 (7)	2	1 (2)
Sex-biased	5	12	12	5	4	6	13	3 (5)	6	2 (5)
Reading level too difficult	34	59	123	43	76	55	42	26 (18)	15	16 (12)
Concepts too difficult	10	14	47	13	26	11	49	20 (20)	14	17 (11)
Inadequate Teacher Guide	4	15	32	10	24	15	30	7 (13)	16	7 (13)
Poorly related to tests used	8	21	32	9	12	22	71	16 (30)	18	18 (14)
Poorly related to later courses	4	7	34	14	13	8	68	18 (28)	24	11 (19)
Too many trivial lessons	12	19	34	16	27	14	68	27 (29)	20	9 (16)

We were interested in the major criticisms of textbooks that are in current use. Many teachers during the case study site visits had indicated that the reading level of many texts was too difficult. It was felt that responses to this item might provide insights into future directions for text and material development. Our results indicated a wide diversity of opinion on this question. Administrators, supervisors and teachers selected "reading level too difficult" over twice as often as any other response; yet a much smaller proportion of students (26%) and their parents (16%) indicated that this is a major problem. Students criticized the texts as being out-of-date and said that they contain too many trivial lessons. Approximately one-fifth of the teachers and administrators stated that texts are poorly related to tests. Apparently, the question of sex biasedness is not seen as a problem with current texts.

The next three items asked for opinion on the overall quality of science, mathematics and social studies programs. Respondents were requested to rate each program on a four point scale with excellent=1 and poor=4.

Even though it cannot really be summed up in a word, what do you feel is the overal quality of the high school science program in your district?

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Excellent	14	15	21	10	20	22	20	5 (8)	9	4 (7)
Very good	25	22	109	64	89	50	93	44 (39)	41	28 (33)
Satisfactory	25	58	56	22	42	16	111	46 (46)	59	56 (48)
Poor	1	4	5	1	8	4	11	4 (5)	10	9 (8)
Other	4	3	13	3	7	8	4	2 (2)	4	3 (3)


1.0
4.5
5.0
5.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

What do you feel is the overall quality of the high school math program?

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Excellent	11	6	25	26	20	12	36	25 (16)	11	4 (9)
Very good	27	39	103	40	71	56	99	43 (43)	44	39 (36)
Satisfactory	26	44	57	28	53	25	85	28 (37)	56	39 (46)
Poor	2	7	8	4	9	2	10	4 (4)	9	18 (7)
Other	3	5	11	3	4	5	3	1 (1)	1	0 (1)

What do you feel is the overall quality of the high school social studies program?

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Excellent	6	5	14	10	9	3	33	11 (14)	8	3 (7)
Very good	25	32	89	38	64	48	87	47 (37)	42	39 (35)
Satisfactory	33	56	67	43	61	31	102	38 (43)	58	50 (48)
Poor	3	6	14	4	8	5	11	4 (5)	10	7 (8)
Other	3	1	15	4	10	13	4	0 (2)	2	0 (2)

In general, the overall quality of all programs was rated satisfactory to excellent by overwhelming majorities of all respondent groups. Teachers and supervisors gave higher ratings to science and mathematics than to social studies programs. Administrators and parents rated the quality of all three programs quite similarly while students tended to rate the mathematics program highest. The responses are collapsed below for easier interpretation. Weighted median ratings were computed omitting the "other" responses; a lower median rating indicates a higher overall rating of the program. The table below illustrates that median ratings by supervisors and teachers placed all programs in the very good range. Even the lower ratings of administrators and parents were still in the high "satisfactory" range.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Rated excellent or very good										
Science	39	46	130	74	109	72	113	49 (47)	50	32 (40)
Mathematics	38	44	128	65	91	68	135	68 (59)	55	43 (45)
Social Studies	31	37	103	48	73	52	120	58 (51)	50	43 (42)
Median rating (weighted)										
Science	2.7		2.1		2.1		2.5		2.8	
Mathematics	2.6		2.1		2.2		2.1		2.7	
Social Studies	2.7		2.5		2.5		2.3		2.6	

On the question of the overall quality of education received by most youngsters today, only small proportions indicated they were highly satisfied. The satisfaction was higher among administrators and supervisors than among teachers, students and parents. A majority of all groups reported having mixed feelings. Approximately 30 percent of teachers, senior students and parents said they were quite dissatisfied.

How do you feel about the quality of education most youngsters get today?

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Quite satisfied	31	27	59	20	24	13	21	3 (9)	16	7 (13)
Mixed feelings	41	62	140	75	109	50	165	68 (71)	72	54 (59)
Quite dissatisfied	4	11	20	5	31	33	38	28 (16)	33	39 (27)
I don't know	0	0	0	0	4	5	9	2 (4)	1	0 (1)
Other	1	0	0	0	0	0	1	0 (0)	1	0 (1)

Name one thing for which the PUBLIC schools deserve more praise than they usually get.

Comments	Administrators	Supervisors	Teachers	Students	Parents
	n	n	n	n	n
Concern for individuals and trying to meet a wide range of needs	12	31	24	11	17
Dedication and efforts of personnel	4	22	28	3	12
Educating children, general comments and teaching basic skills	5	19	9	18	5
Turning out good citizens	3	17	10	12	8
Operating as well as they do, managing with budget restrictions	5	17	8	13	7
Really trying, even though the impossible is expected	5	18	9	9	5
Good teaching, teacher competence	2	5	8	16	5
Discipline, social development, compensating for what is missing in the home	6	6	9	7	7

Content analysis of the responses to the above item was performed after the questionnaires were returned. A concern for individual students and the efforts to meet a wide range of student needs was mentioned most often overall as the one thing for which public schools deserve more praise; it was also the most frequent response by administrators, supervisors and parents. Second in frequency of mention overall was the dedication of personnel, including the time and effort they expend. Teachers made this comment more than any other. The third and fourth most commonly cited areas deserving praise were general remarks on educating children and teaching them basic skills, especially noted by supervisors and the most frequent response of students; and general comments on turning out good people and citizens prepared for life. Other remarks included schools operating as well as they do and managing with budget restrictions as well as the effort that school personnel really make, even when the impossible is expected. Good teaching and teacher competence were especially noted by students and there was general acknowledgement of teacher efforts in the areas of discipline and social development. A substantial number of students, 16, mentioned the quality of the extra-curricular programs, including art, music and sports as a good thing about schools.

It is perhaps worth indicating some of the general areas that did not receive much praise from our respondents. Only 13 overall listed the curriculum and this included no administrators or teachers. Only 2 students and 2 parents mentioned the facilities as worthy of praise and a total of 5 respondents, including 4 administrators, said that schools should be commended for getting parents involved and promoting community support.

Page Four, Format 2: Concerns About Education Today. The second of the three pages of general interest questions contained 12 items to which respondents were asked to indicate true, false or I don't know and a list of possible funding projects from which three should be selected. This page was also randomly administered to approximately one-third of each group and was responded to by 77 administrators, 243 supervisors, 179 teachers, 251 senior students and 144 parents for a total sample of 894 persons.

The true-false responses to each item are reported below and, as such, are very easy to interpret. Only findings of special interest are highlighted following the questions.

Teachers seldom use TV, museums, and community resources to supplement teaching.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	22	19	81	34	58	26	167	69 (67)	62	24 (44)
False	55	81	154	66	109	68	70	28 (28)	72	74 (51)

Students would get a better education if there were regular discussions and firm curricular arrangements between teachers at different grade levels.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	61	60	220	93	144	75	168	66 (68)	114	75 (83)
False	6	19	9	1	19	19	26	15 (11)	9	3 (7)

The schools have been creating "new" courses and having students work on topics of their own choosing. As a result of these and other circumstances, the schools give too little emphasis to the basic knowledge and skills that every youngster should learn.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	30	55	123	71	98	57	88	42 (36)	90	64 (64)
False	34	39	81	25	48	23	126	35 (51)	39	30 (28)

The general public does not put high priority on the teaching of science.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	34	59	120	54	78	50	123	59 (50)	80	48 (57)
False	31	18	98	42	69	37	74	27 (30)	48	47 (34)

The general public does not put high priority on the teaching of math.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	9	4	41	23	36	19	74	36 (30)	46	29 (33)
False	66	95	190	76	121	75	128	45 (52)	90	69 (64)

The general public does not put high priority on teaching social studies in a way that emphasizes a scientific approach to studying social issues.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	55	82	185	79	105	65	121	40 (50)	80	58 (60)
False	12	11	23	9	17	7	56	28 (23)	26	17 (19)

Tight budgets have caused schools to cut back on purchases of textbooks and materials so that it is lowering the quality of instruction.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	26	36	96	35	86	38	136	61 (56)	60	35 (43)
False	43	61	118	59	77	55	74	26 (30)	63	53 (45)

For most teachers the most basic goals are attitudinal or moral in character. Subject matter is more a vehicle than an objective in its own right. Mastery of subject matter is sought, but rule-following (social and academic) is more basic.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	22	13	74	37	69	34	129	50 (53)	61	41 (46)
False	40	63	126	57	59	46	50	14 (21)	40	29 (30)

Authorities are urging teachers to be more specific about instructional goals. If curriculum guides and lessons do get much more specific, the curriculum will over-emphasize simplistic skills and memorization of isolated facts.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	27	38	99	41	74	44	125	42 (52)	52	18 (39)
False	38	41	109	53	68	42	66	38 (27)	50	44 (38)

The role of the high school science department today is simply to provide one biology course for all students and 2-3 other courses for the college-bound students.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	19	37	63	23	46	28	123	50 (50)	77	56 (56)
False	48	45	138	73	84	39	90	27 (37)	39	37 (28)

Our school district does not seem to be able to obtain objective evidence of student achievement that would persuade a skeptical visitor that the science teaching here is clearly effective.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	22	30	85	41	53	26	88	26 (37)	48	35 (36)
False	38	54	112	42	67	34	85	43 (36)	49	33 (36)

Teachers do not have master teachers available, nor coordinators, nor consultants, nor teacher networks to help them when they need help with their teaching.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
True	33	52	94	49	81	41	88	48 (36)	55	26 (41)
False	41	48	135	48	77	37	85	27 (35)	47	42 (35)

Respondents felt that firm curricular arrangements between teachers at different grade levels would result in better education (60 to 90% agreement); that specification of curricular goals will lead to over-emphasis of simplistic skills and memorization of isolated facts (38 to 52% disagreement); and that the school district does not have objective evidence of clearly effective science teaching (26 to 41% agreement).

Three items were directed toward the high priority placed by the public on the teaching of science, mathematics and social studies. In general, respondents agreed that a high priority is not placed on the teaching of science (48 to 59%) and on teaching social studies in a way that emphasizes a scientific approach to studying social issues (57 to 81%), except for students with only 40 percent agreeing to the latter statement. Percentages were almost reversed for the teaching of mathematics with large proportions saying that a high priority is placed on the teaching of these subjects. It is not difficult to understand the higher priority assigned to mathematics. Responses to an earlier question in Scenario V on Back-to-the-Basics indicated that reading and arithmetic are prerequisite skills for later course work.

Only students agreed that substantial use is made of TV, museums and other community resources and that tight budgets have resulted in cutbacks on the purchase of texts and materials. There was less agreement among students that "new" courses have resulted in less emphasis on basic knowledge and skills (only 42 percent compared to over half of all the other respondent groups).

The mastery of subject matter was seen as more important than social and academic rule-following by substantial proportions of school people (46 to 62%) but only 29 percent of parents and 14 percent of students responded in this way. The role of the science department is also in question. Approximately half of the students and teachers reported that this role is simply to provide a biology course for all students and 2 to 3 other courses for college-bound students, while only 23 percent of supervisors and 28 percent of teachers said this is the case. Finally, school personnel were almost evenly split over whether or not there are adequate consultants or teacher networks available to assist teachers with their teaching problems.

The final question for this group was a list of projects some people think should be federally funded from which three were to be selected. It was our hope that the results to this item might provide direction to the National Science Foundation in the kinds of programs viewed as deserving support.

If the federal government were going to do more to support science teaching in the schools, what do you think it should do? In the following list please check three that you feel are most worthy of funding.

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Additional research on science teaching & learning	21	22	69	20	38	16	92	38 (37)	44	25 (31)
Hire and pay resource people to help teachers with their teaching skills	38	57	118	47	60	31	58	14 (23)	43	26 (31)
Provide free telephone networks for teachers to help other teachers	5	2	10	4	11	4	22	6 (9)	8	12 (6)
Provide additional institutes for the improvement of teaching	38	46	150	61	73	31	66	24 (26)	35	32 (25)
Develop "basic math" workbooks and materials	8	13	32	19	49	35	38	17 (15)	43	46 (31)
Develop science courses oriented to present and future job markets	34	46	98	45	92	51	141	52 (56)	72	37 (51)
Undertake a public campaign to promote "scientific literacy"	14	17	50	18	30	17	24	6 (10)	16	13 (12)
Provide textbooks to schools at low cost or no cost	14	21	27	16	34	18	77	38 (31)	35	33 (25)
Provide films and lab materials to schools at low cost or no cost	37	73	80	39	92	53	158	65 (65)	68	56 (49)
Subsidize the early retirement of ineffective teachers	7	4	20	11	12	9	34	13 (14)	16	14 (11)
Provide awards for outstanding teaching	19	12	31	18	21	8	36	24 (15)	31	20 (22)

There was little support by any group to provide free telephone networks for teachers or to subsidize the early retirement of ineffective teachers. Only small proportions selected providing awards for outstanding teaching or undertaking a public campaign to promote "scientific literacy."

The two suggestions receiving the most support were providing film and lab materials to schools at little or no cost (39 to 72%) and developing science courses that are oriented to present and future job markets (37 to 52%). Administrators and supervisors additionally checked hiring resource people to assist teachers with problems (56 to 47%) and providing institutes to improve teaching (46 to 61%). Smaller proportions of students (38%) said it was desirable to provide low or no cost textbooks and to support additional research on science teaching and learning. Teachers (35%) and parents (46%) suggested the development of "basic math" workbooks and materials as worthy of federal support.

Page Four, Format 3: Purposes of Education. Basic to many of the issues raised in the case studies and addressed both by their authors and the subsequent survey is the main purpose of our schools. Gooler* attempted to determine what the goals of our educational systems should be. One category of goals he studied was the "very broad purposes of education, primarily couched in terms of what the student should experience or do in a school, as well as what he should become." Gooler selected the human, knowledge and career purposes of education as the three broad areas to investigate. His questions and the general format were reproduced and administered at random to approximately one-third of each respondent group. Results are based upon the answers of 81 administrators, 203 supervisors, 178 teachers, 240 students and 131 parents for a total sample of 833.

The HUMAN purpose of Education

The main responsibility of the schools should be to experience what human society is--the history, human values, work and play, the arts and sciences, what men and women have accomplished and what they have failed to accomplish. The schools should give students the opportunity to be a participant in the human experience, the aesthetic and emotional experience as well as the intellectual experience.

The statement directly above tells us--in my opinion--what should be

	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
The most important task of the schools	25	36	55	27	53	39	90	30 (39)	31	18 (25)
An important tasks, but not the most important tasks of the schools	50	52	135	69	113	58	121	52 (52)	80	64 (64)
A relatively unimportant tasks of the schools	3	12	6	4	7	3	18	16 (8)	10	17 (8)
A task that the schools should not undertake	0	0	0	0	2	1	3	2 (1)	4	1 (3)

The KNOWLEDGE Purpose of Education

The main responsibility of the schools should be to help young men and women know all about the world. Each student should have maximum opportunity to study the basic facts and concepts of nature, technology, commerce, the languages, the fine arts and practical arts. The schools should help young men and women build skills for explaining--and even discovering--new knowledge.

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*Gooler, Dennis, "Strategies for Obtaining Clarification of Priorities in Education," (Ph.D. diss., University of Illinois, 1970).

The preceeding statement tells us--in my opinion--what should be

	Adminis-trators		Super-visors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
The most important task of the schools	28	36	88	62	72	44	98	45 (42)	65	49 (51)
An important task, but not the most important tasks, of the schools	47	54	107	38	100	56	126	51 (54)	57	46 (45)
A relatively unimportant tasks of the schools	3	10	0	0	2	0	5	1 (2)	4	4 (3)
A task that the schools should not undertake	C	0	0	0	1	0	3	2 (1)	1	1 (1)

The CAREER Purpose of Education

The main responsibility of the schools should be to prepare young people for their life-work. Though most careers require training on the job and continuing education throughout life, the schools should lay the foundation for successful work. For students who will take further training in technical schools or professional college, the schools should emphasize entrance requirements and preparatory skills.

The statement directly above tells us--in my opinion--what should be

	Adminis-trators		Super-visors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
The most important task of the schools	20	19	44	31	65	25	107	48 (46)	86	78 (68)
An important task, but not the most important task, of the schools	53	81	143	66	103	71	113	48 (49)	39	21 (31)
A relatively unimportant task of the schools	4	1	8	3	4	2	10	4 (4)	2	1 (2)
A task that the schools should not undertake	0	C	1	0	2	1	2	1 (1)	0	0 (0)

There was general agreement among all groups that all three of the purposes of education - human, knowledge and career - are important. It is apparent that some people selected more than one purpose as the most important task of the schools (since percents do not sum to 100 within each response group). The weighted median rankings of each group are presented below.

Weighted Median Rank

	Human	Knowledge	Career
Administrators	1.8	1.8	1.9
Supervisors	1.8	1.4	1.7
Teachers	1.7	1.6	1.8
Students	1.9	1.6	1.5
Parents	2.0	1.5	1.1

The most important task was assigned rank = 1 and a task the schools should not undertake was assigned rank = 4; thus a lower number indicates a higher ranking. The ratings of the HUMAN purpose and the KNOWLEDGE purpose of education were tied for the highest priority of schools by administrators, while supervisors and teachers both assigned the highest priority to KNOWLEDGE purpose. These results are consistent with Gooler's research in which three of four teacher groups selected the KNOWLEDGE purpose.* Both students and parents, on the other hand, selected the CAREER purpose of education with the KNOWLEDGE purpose being rated second. The CAREER purpose was rated second by supervisors and third by both administrators and teachers. The ratings given by both administrators and teachers were very close in value; parent ratings resulted in the greatest discrimination among the three purposes.

After rating each purpose as above, the respondents were asked how the three purposes are currently being emphasized in their schools.

How are these three purposes now being emphasized in your school(s)?

The HUMAN purpose	Administrators		Supervisors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Only a little	12	32	49	19	63	22	106	44 (47)	35	52 (31)
Quite a bit	43	54	126	58	89	61	85	42 (38)	57	34 (50)
More than the other 2	18	14	16	6	17	15	25	10 (11)	17	9 (15)
Far more than the other 2	1	0	5	16	3	2	9	4 (4)	5	4 (4)

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*Dennis Gooler, "Strategies for Obtaining Clarification of Priorities in Education," (Ph.D. diss., University of Illinois, 1970).

The KNOWLEDGE purpose	Adminis-trators		Super-visors		Teachers		Students		Parents	
	n	%	n	%	n	%	n	%	n	%
Only a little	5	4	10	7	23	10	36	14 (16)	18	9 (15)
Quite a bit	38	49	83	33	81	43	109	51 (48)	55	67 (47)
More than the other 2	24	27	76	39	50	37	58	28 (25)	34	19 (29)
Far more than other 2	7	20	27	21	15	10	25	8 (11)	11	5 (9)

The CAREER purpose										
Only a little	18	32	57	26	43	35	42	14 (18)	35	29 (29)
Quite a bit	41	38	95	45	83	48	78	33 (34)	50	25 (42)
More than the other 2	8	23	32	11	31	9	60	35 (26)	22	40 (19)
Far more than other 2	7	6	12	17	14	8	48	18 (21)	12	7 (10)

A larger proportion of administrators, supervisors and teachers indicated that the KNOWLEDGE purpose is receiving the most emphasis in their schools. Students and their parents stated that the CAREER purpose is receiving the most emphasis. Thus, our respondents appear to believe that the reality is consistent with their opinion of which purpose should be important. The weighted median ratings presented below indicate, however, a wider range of ratings among the three purposes within each group than were evident on the "purpose" questions. Again, a lower rating indicates a higher priority.

Weighted Median Rating

	Human	Knowledge	Career
Administrators	2.2	1.6	2.0
Supervisors	1.8	1.3	1.8
Teachers	2.0	1.6	2.2
Students	2.4	1.8	1.4
Parents	2.5	1.9	1.6

SUMMARY

Case Studies in Science Education (CSSE), sponsored by the National Science Foundation, was one of three projects funded in 1976 to assess the status of science education in American schools. CSSE consisted of three distinct phases: on-site observation of case studies of conditions and characteristics of science education in eleven school districts by an experienced ethnographer; site visits to the same eleven districts by project personnel and specialists in science education; and a national survey to corroborate case study findings.

The original intent to use the survey to confirm case study findings was thwarted by the difficulty of representing complex local circumstances in survey language. No particular major findings from the case studies were refuted by the survey and the general tone of conditions regarding science education in the schools was, in fact, consistent between the two data sources.

The present chapter presents findings from the national survey of district superintendents, principals, curriculum supervisors, teachers, high school counselors, senior students and their parents. Demographic and experienced-related questions, specially devised scenarios each consisting of an illustrative situation and questions, and general items on science education were included in a four page questionnaire that was designed in 66 versions to relate to specific samples of respondents. The superintendent, principal, supervisor and teacher samples were selected by Research Triangle Institute following rigorous and traditional sampling procedures. Follow-up procedures included a postal card reminder and a second questionnaire. The counselor, student and parent samples were selected by CSSE project personnel following telephone contact with principals of schools with grades 10 through 12. Counselors were not followed up. Students and parents were surveyed by obtaining the cooperation of 27 counselors in selecting a representative senior class and having each student present on the day of administration complete a questionnaire. Parents of these same students were mailed questionnaires and contacted for follow-up by the cooperating counselors.

The questionnaires contained both categorized and free response items. The former were computer analyzed; raw frequency and weighted response percentages were reported (along with unweighted percentages for counselors, students and parents). The free response items were primarily content analyzed manually and only frequency tabulations were reported in most cases.

Any attempt to summarize the responses of 22 separate groups on a large number of issues involving over 800 distinct questions could be described as foolhardy. The data have been collapsed in presenting the results thus far and any further reduction seems counterproductive. Thus, although major findings will be highlighted on the following pages, it must be kept in mind that many important insights are neglected or insufficiently emphasized. In addition, the results of each case study are written as a separate chapter in the present report. Other chapters contain an assimilation of case study and survey findings and an executive summary is presented in Chapter 19. The reader of this chapter is encouraged to peruse the remainder of this report in order to place the survey findings in a proper perspective.

Description of Response Groups. Response rates of approximately 60 percent overall were achieved. Respondents included one superintendent sample (n=74); three principal samples of elementary (n=59), grades 7 through 9 (n=47) and grades 10 through 12 (n=54); five supervisor samples of K through 6 science (n=134), K through 6 mathematics (n=116), 7 through 12 science (n=139), 7 through 12 mathematics (n=132) and 7 through 12 social studies (n=153); one counselor sample (n=46); seven teacher samples of K through 6 (n=78), 7 through 9 science (n=93), 7 through 9 mathematics (n=81), 7 through 9 social studies (n=42), 10 through 12 science (n=101), 10 through 12 mathematics (n=94) and 10 through 12 social studies (n=41); two senior samples (n=361 and 375); and three parent samples (n=111, 142 and 148).

The school personnel respondents were generally quite experienced. High school principals reported the least amount of experience in their present positions, a weighted average of 5.5 years; mathematics teachers of grades 7 through 9 were the most experienced with a weighted average of 12.7 years in teaching.

The weighted average enrollment of the school districts was 4600 students according to the superintendent responses. Our principals reported average school enrollments as 390 in elementary schools, 580 in grades 7 through 9 and 760 in grades 10 through 12, respectively. Estimates of annual per pupil expenditures ranged from averages of $936 to $1250.

A substantial majority of the curriculum supervisors, ranging from 62 to 96 percent in the five subsamples, indicated that their primary responsibility is something other than curriculum supervisor. Many were teachers or administrators and, as a whole, devoted less than one-half of their time to supervising activities.

The most commonly taught courses, according to our teacher respondents, were general science, general math and American history in grades 7 through 9; biology, algebra (followed closely by geometry) and American history in grades 10 through 12. The courses most frequently taken by high school students were reported by our seniors as American history, algebra, biology, geometry, general science, and basic math. In the high schools, 25 percent of the science teachers said they were currently teaching chemistry or physics but only 12 percent of math teachers were teaching advanced math courses and similar proportions of social studies teachers reported teaching psychology (11%) or sociology (7%).

Approximately one-third of the supervisors indicated they had attended National Science Foundation institutes, except for secondary science supervisors of whom 60 percent reported having participated. The percentages of teachers who had been involved in NSF institutes ranged from 10 percent of secondary social studies teachers to 46 percent of secondary science teachers. However, this latter group reported the lowest average number of institutes attended for all groups.

Seventy percent of our student samples indicated that they plan to be in college next year. As a total group, they said social studies courses were most interesting but also overemphasize facts and memorization. More of them said that math classes stress basic facts and are too much aimed at "bright" kids. Science courses, along with those in math and social studies were viewed as boring by approximately one-third of the students.

Parents of seniors were, in general, well educated; 85 percent had finished high school and over 30 percent reported having completed college. Over 70 percent said they consider themselves politically conservative or middle-of-the road. Almost all reported that they pay at least a small amount of attention both to their students' work and problems of the schools.

Summary of Scenarios. Eight scenario situations and attendant questions were devised to depict current issues or problems in science education. Each was administered to two or more respondent groups.

Scenario S on budget cuts asked superintendents, science supervisors (grades 7 through 12) and one group of parents to react to various consequences of funding constraints. A majority of superintendents and parents reported no recent budget cuts and larger proportions of all groups indicated that any such cuts had no adverse effect on the science curriculum. In a similar question in another scenario, larger proportions of social studies teachers, students and parents reported budget cuts; 30 percent of these teachers said that class size had been increased and one-fourth stated that there is now more textbook teaching. When asked to select the most acceptable actions they would take in response to budget cuts, all three groups would eliminate extra-curricular activities. The least attractive options were elimination of physics and chemistry courses and of the locally funded assistance to handicapped children. When queried about vocational goals of science courses, there was a general tendency to suggest that science courses be more vocationally oriented; yet large majorities would select a good general education over a good vocational education if forced to choose between the two.

Responding to questions on Scenario T, approximately half of the science supervisors (grades K through 6), principals (grades 10 through 12) and one group of parents indicated opposition to a higher degree of uniformity in the curriculum. Over three-fourths agreed that uniformity could be an obstacle to providing flexible education programs. Most indicated that the goals of traditional and objective-based curricula are similar and that these two approaches do not compete for funds. In another part of the questionnaire, one-third of all survey respondents were asked if more specific curriculum guides and lessons would lead to an over-emphasis on simplistic skills and memorization of facts. All groups were almost evenly split on this question except parents who indicated that greater specificity would not result in the above outcomes. The most popular reasons for clarifying what is taught in each grade were to make teachers' jobs more manageable and to make goals clear to students. When one-third of all survey respondents were asked if regular discussions and firm curricular arrangements between teachers would result in a better education for students, they overwhelmingly supported this idea.

The back-to-the basics movement was one of the most important issues investigated, both in the case studies and in the survey, and was the topic in Scenario U. Over 60 percent of both social studies supervisors (grades 7 through 12) and mathematics teachers (grades 10 through 12) and over 70 percent of elementary school principals replied that this is an important issue. Many indicated that there should be greater emphasis on basic skills. A majority of each group indicated that, although science is basic, the 3 R's must be taught first; however, small proportions of supervisors and principals said that people who stress the 3 R's do not understand today's need for education. When asked the amount of attention that is needed on prerequisite skills, course objectives, abstract concepts, facts and rules, and setting proficiency levels, only one item, emphasis on facts and rules, was felt to need less attention--and that only by the supervisors. In response to why students are graduating from high school unprepared in reading and arithmetic, major reasons were that government regulations were making schools promote unqualified students and that schools push poor learners through to get rid of them. Textbooks were seen as adequate and teachers as competent by a majority of each group.

An issue of importance to all teachers is how to teach abstract concepts and logic. A situation in which a child correctly answers a math question [illegible] terms of fractions but not in decimal form was used to illustrate this [illegible] in Scenario V. Math supervisors (kindergarten through grade 6) and math teachers (grades 7 through 9) said that teacher centers or a network of fellow teachers would provide welcome help in dealing with such problems. There was an expressed concern for assistance in methods of teaching mathematical concepts and a general satisfaction with teacher levels of content expertise. Both groups indicated that students have been promoted without knowing basic mathematics. They agreed that teachers feel it is their primary responsibility to prepare children for the next year, even at the expense of reducing the amount of time spent on the broader aims of education.

Field observers noted that some teachers concentrate on drills and worksheets in order to keep children occupied in the classroom; others opt for individualized instruction. In response to Scenario W on socialization and classroom behavior, a majority of principals (grades 7 through 9) and elementary school teachers agreed that teachers are concerned about keeping pupils busy and productive. Surprisingly large proportions, 29 percent of principals and 42 percent of the teachers, said that teaching children to be considerate, respectful and to follow directions is more important than having students understand subject matter content; almost none said it was less important. A similar question stated that mastery of subject matter is important, but rule-following (social and academic) is a more basic goal of teachers and was asked of one-third of all survey respondents. Approximately 35 percent of supervisors, teachers and parents agreed that this is true. With regard to pupils seeing teachers make mistakes, large percentages said it is very definitely good and that students should be allowed to discover and discuss the errors. Yet over 70 percent of each group said that less than 25 percent of teacher time is spent in inquiry teaching, primarily because the necessary equipment and supplies are difficult to provide and students have difficulty carrying out inquiries effectively.

Inservice training and support personnel to help with pedagogic problems was the subject of Scenario X responded to by mathematics supervisors (grades 7 through 12) and science teachers (grades 7 through 9). The climate for solving such problems was viewed as good by more supervisors than teachers; a distressing 20 percent of the teachers indicated that "no one cares." Both groups said that teachers can help one another although substantial numbers mentioned that there is not enough time for such helping activities. In another part of the questionnaire, one-third of all survey respondents were asked whether or not teachers have master teachers, coordinators, consultants, etc., available to help them with their teaching. School personnel were almost evenly split in responding to the availability of such resources. More students and fewer parents thought that this kind of help was not available. NSF and similar institutes were seen as valuable with more than half of the teachers expressing a wish for more activities such as these. According to teachers, the best thing universities could do to help them would be develop curricula more appropriate to the times. Supervisors agreed but also suggested courses oriented to teacher needs.

Scenario Y dealt with the teaching of controversial topics in social studies and was administered to social studies teachers (grades 7 through 9 and grades 10 through 12), students and parents. Generally, these people said that teachers said that teachers should communicate to students how they feel on specific issues as long as they indicate their value orientation and also present alternative views. A majority supported the use of federal funds for the development of teaching materials that include controversial topics, especially if it would not cause trouble; one-third of the parents, however, stated that federal monies should never be spent on such projects. The two most common complaints about the social studies curriculum were too much emphasis on facts instead of concepts, especially by 7 through 9 teachers and students, and not enough emphasis on teaching about personal values.

The final scenario, Z, investigated elitism in science and attitudes about science courses. Over 80 percent of the counselors, science teachers of grades 10 through 12 and students responding to this scenario did not feel that science courses are too difficult. They said that dissatisfaction was due to student immaturity or the irrelevance of the subject matter. Forty percent of the students said that teachers want mostly to teach "pure" science rather than how it is used in everyday life. Teachers and students felt the balance between text and lab work is about right while counselors opted for more lab experiences. Over 70 percent agreed that junior and senior science courses are aimed primarily toward college-bound students; about half recommended that more science courses for the "below average" student be offered. In another part of the questionnaire, one-third of all survey respondents were asked if the role of high school science departments is to provide one biology course for all students and 2-3 courses for students going to college. Approximately 25 percent of supervisors and teachers said yes, as did 37 percent of the administrators. Over half of the students and parents also agreed. As a group, the teachers were quite critical of science courses, stating that too much time is spent on remedial math and teaching reading and that classes are too large with class periods too short. Both they and counselors felt that lab facilities and field arrangements are inadequate.

Summary of General Questions. Respondents were combined into 5 major groups of administrators, supervisors, teachers, students and parents. Three sets of general questions on science education were formulated and each set was administered at random to one-third of the 5 combined respondent groups.

The biggest problem with which public schools must deal was said to be budget priorities. About one-third of another group of respondents indicated that budget cuts had resulted in decreased purchases of textbooks and a lowering of the quality of instruction. Another major problem cited was apathy on all levels--student, community and parents. With students, this leads to a lack of motivation and absenteeism. Student discipline was the problem mentioned by the fourth largest number of people. Some of the best things about the schools were the concern for the individual student's needs and the dedication and effort of school personnel.

Students should be required to pass a standard examination in order to graduate from high school according to the majority of all groups, except administrators of whom 42 percent agreed. These same respondents said that minimum competency levels in science should also be required, with proportions quite similar to those on the first question.

The overall quality of science programs was responded to by one of the three sets of combined groups and the priority placed on teaching was indicated by a second set of combined groups. Administrators and parents tended to rate science, mathematics and social studies programs as having similar quality while supervisors and teachers rated the first two programs higher than social studies. Students gave mathematics the highest rating with social studies second. A slight majority of the second set of combined groups tended to agree that the public does not put high priority on the teaching of science. Substantially higher proportions of all groups except students felt the same about the teaching of social studies in a way that emphasized a scientific approach to studying social issues. In the case of mathematics, however, all groups and over 75 percent of the school personnel indicated that a high priority is placed on the teaching of this subject. This emphasis on the teaching of mathematics is puzzling unless we assume that math is seen as part of the "basic" skills--definitely an area of concern to our respondents. This same group responded "yes" by a ratio of about 2 to 1 to a statement that schools give too little emphasis to the basic knowledge and skills that every youngster should learn, except for students who were more evenly split. And, in Scenario U, there was evidence for supporting increased teaching emphasis in this area.

The school personnel among our respondents would support the use of federal funds to hire and pay resource people and to provide additional institutes for the improvement of teaching. All groups approved of such funds to develop science courses oriented to present and future job markets and to provide films and lab materials at low or no cost to schools.

One set of the combined groups responded to a series of questions on the general purposes of education. Supervisors and teachers both rated the knowledge purpose highest; students and parents selected the career purpose most frequently.

Administrator responses were close on all three purposes, but gave slightly higher ratings to the human and the knowledge purposes of education. When asked how these purposes were currently being emphasized in their schools, all school personnel groups said that the knowledge purpose is given greatest emphasis; students and parents again indicated that it was the career purpose.

Conclusion. How do people feel about science education in America today? Are there problems? Are they solvable? What are the strengths? the weaknesses? Do administrators feel differently from teachers? school personnel from students and parents? What programs are needed?

These are some of the questions in the minds of those concerned with science education. This chapter has presented information collected by a national survey from different types of school personnel, students and parents that provides partial answers to these questions. What can be said after all these data have been collected, collated, tabulated, analyzed and interpreted? A few comments seem permissible.

It must be noted that the findings reported thus far do not exhaust those possible from the data. The present chapter has concentrated on total group responses; no attempt has been made to compare responses from different geographic areas or from persons with different kinds of experiences. Thus the following comments are based upon general impressions and it is recognized that additional insights might be obtained with further massaging of these data.

According to the survey responses, budget cuts have been real and have made their impact felt. This concern was not as pervasive as was anticipated but substantial proportions stated that budget constraints were a real problem. There were no attractive actions to take in the face of these cuts. Some people suggested trimming of extra-curricular and athletic programs. Others said it would be better to cut back a little in all areas rather than make large reductions in any one program.

There was concern about discipline. This topic, along with budget problems, student apathy and lack of community support, was one of the four problems most commonly mentioned by a cross-section of each group. All respondents were concerned with behavior in the classroom; rule-following and training youngsters to be considerate and respectful were high priorities--some said they were more important than teaching content.

The basics were emphasized. Some people said the emphasis on basic skills of reading and arithmetic was nothing new--they had always given priority to teaching these subjects. Others, however, viewed the back-to-the-basics movement as a return to the important things in education. Our respondents clearly felt that the public places a higher priority on the teaching of mathematics than on the two other areas, science and social studies. This concern was confirmed by the advocacy of minimum competency examinations: students graduating from high school should be capable of demonstrating basic competencies--even in science, according to our respondents.

There appeared to be general satisfaction with the science curriculum. Moderate criticism of current textbooks was accompanied by the request for assistance with the development of more relevant curriculum materials. Texts were seen as important, evidenced by the concentration on textbook teaching as opposed to laboratory and out-of-school experiences. Many teachers noted their desire for more time to devote to curriculum development: specifying course objectives and finding ways to emphasize abstract concepts. While many stated they did not want greater uniformity, there was a clear concern for teaching the skills and concepts needed for the next course or the next grade in school.

Teachers also expressed a desire for more assistance with pedagogic problems. The general quality of content expertise was seen as acceptable, but courses oriented to specific teacher needs were suggested, as was greater availability of teacher consultants. Many of the teachers and supervisors reported having attended a number of institutes and inservice courses; most felt they were useful and many would like more such offerings.

There appeared to be an open-mindedness when it came to teaching style and the inclusion of topics dealing with controversial subjects. The respondents said that teachers have a right to present their own opinions, although they should also discuss alternate views. Substantial numbers indicated that the development of curricular materials dealing with controversial topics was an area worthy of federal funding.

The subject of grouping and tracking was one of concern. While this practice was seen as unfair to some children, it was selected by many as the approach most likely to result in effective instruction. Our respondents seemed to be indicating that grouping was undesirable from the point of view of what is legally right but was almost unavoidable due to heterogeneity of student abilities.

Our respondents recognized the multifaceted purposes of education. They were asked specifically about three: the human, knowledge and career purposes. There were some small differences in the rankings of these three purposes by the different groups. However, in general, the knowledge and career purposes were seen as especially important and the human purpose was not far behind.

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APPENDIX TO CHAPTER 18

What do you think are the biggest problems with which the PUBLIC schools in this community must deal?

Some of our contemporary social problems are: health care, poverty, abortion, discrimination, and graft. Some people want the social studies to be taught so that pupils learn how to analyze these problems. Some people want the schools to avoid discussion of offensive social problems. How do you feel?

___Elementary school pupils should learn to analyze such problems.
___Pupils should be made aware of the problems but "problem-analysis" is not a suitable goal for the elementary school social studies program.
___Contemporary social problems are not suitable topics for the grade school.
___Other:

Should all high school students in the United States be required to pass a standard examination in order to get a high school diploma?
___Yes, they should ___No, they should not ___I don't know

Should school districts require some minimum competency level in science for all students to attain in order to graduate from high school?
___Yes, they should ___No, they should not ___I don't know

What are the major criticisms of the textbooks that are being used in your school? (Check as many as you wish.)
___out-of-date
___simplistic
___sex-biased
___reading level too difficult
___concepts too difficult
___inadequate Teacher Guide
___poorly related to tests used
___poorly related to later courses
___too many trivial lessons

Even though it cannot really be summed up in a word, what do you feel is the overall quality of the high school science program in your district?
___excellent ___very good ___satisfactory ___poor ___other:
What do you feel is the overall quality of the high school math program?
___excellent ___very good ___satisfactory ___poor ___other:
What do you feel is the overall quality of the high school social studies program?
___excellent ___very good ___satisfactory ___poor ___other:

How do you feel about the quality of education most youngsters get today?
___quite satisfied ___mixed feelings ___quite dissatisfied ___I don't know
Please comment if you would like to:

Name one thing for which the PUBLIC schools deserve more praise than they usually get:

People in your community and elsewhere are concerned about education today. On each of the lines below, please help us understand these concerns.

T = Yes, I think the statement is true.   ? = I don't know.
F = No, I think that the statement is not true.

_____ Teachers seldom use TV, museums, & community resources to supplement teaching.

_____ Students would get a better education if there were regular discussions and firm curricular arrangements between teachers at different grade levels.

_____ The schools have been creating "new" courses and having students work on topics of their own choosing. As a result of these and other circumstances, the schools give too little emphasis to the basic knowledge and skills that every youngster should learn.

_____ The general public does not put high priority on the teaching of science.

_____ The general public does not put high priority on the teaching of math.

_____ The general public does not put high priority on teaching social studies in a way that emphasizes a scientific approach to studying social issues.

_____ Tight budgets have caused schools to cut back on purchases of textbooks and materials so that it is lowering the quality of instruction.

_____ For most teachers the most basic goals are attitudinal or moral in character. Subject matter is more a vehicle than an objective in its own right. Mastery of subject matter is sought, but rule-following (social and academic) is more basic.

_____ Authorities are urging teachers to be more specific about instructional goals. If curriculum guides and lessons do get much more specific, the curriculum will over-emphasize simplistic skills and memorization of isolated facts.

_____ The role of the high school science dept. today is simply to provide one biology course for all students and 2-3 other courses for the college-bound students.

_____ Our school district does not seem to be able to obtain objective evidence of student achievement that would persuade a skeptical visitor that the science teaching here is clearly effective.

_____ Teachers do not have master teachers available, nor coordinators nor consultants nor teacher networks, to help them when they need help with their teaching.

If the federal government were going to do more to support science teaching in the schools, what do you think it should do? In the following list please check three that you feel are most worthy of funding: (only 3)

_____ additional research on science teaching and learning
_____ hire and pay resource people to help teachers with their teaching skills
_____ provide free telephone networks for teachers to help other teachers
_____ provide additional institutes for the improvement of teaching
_____ develop "basic math" workbooks and materials
_____ develop science courses oriented to present and future job markets
_____ undertake a public campaign to promote "scientific literacy"
_____ provide text books to schools at low cost or no cost
_____ provide films and lab materials to schools at low cost or no cost
_____ subsidize the early retirement of ineffective teachers
_____ provide awards for outstanding teaching

Copy of questionnaire, p 4
Format 3

Each of the three paragraphs below has been said to be THE MAIN PURPOSE of our schools.
Which do you think the schools should do?
Please circle one letter below each paragraph.

The HUMAN Purpose of Education

The main responsibility of the schools should be to experience what human society is--the history, human values, work and play, the arts and sciences, what men and women have accomplished and what they have failed to accomplish. The schools should give students the opportunity to be a participant in the human experience, the aesthetic and emotional experience as well as the intellectual experience.

THE STATEMENT DIRECTLY ABOVE TELLS US -- IN MY OPINION -- WHAT SHOULD BE

- (a) THE MOST IMPORTANT TASK OF THE SCHOOLS.
- (b) AN IMPORTANT TASK, BUT NOT THE MOST IMPORTANT TASK, OF THE SCHOOLS
- (c) A RELATIVELY UNIMPORTANT TASK OF THE SCHOOLS.
- (d) A TASK THAT THE SCHOOLS SHOULD NOT UNDERTAKE.

The KNOWLEDGE Purpose of Education

The main responsibility of the schools should be to help young men and women know all about the world. Each student should have maximum opportunity to study the basic facts and concepts of nature, technology, commerce, the languages, the fine arts and practical arts. The schools should help young men and women build skills for explaining--and even discovering--new knowledge.

THE STATEMENT DIRECTLY ABOVE TELLS US -- IN MY OPINION -- WHAT SHOULD BE

- (a) THE MOST IMPORTANT TASK OF THE SCHOOLS.
- (b) AN IMPORTANT TASK, BUT NOT THE MOST IMPORTANT TASK, OF THE SCHOOLS.
- (c) A RELATIVELY UNIMPORTANT TASK OF THE SCHOOLS.
- (d) A TASK THAT THE SCHOOLS SHOULD NOT UNDERTAKE.

The CAREER Purpose of Education

The main responsibility of the schools should be to prepare young people for their life-work. Though most careers require training on the job and continuing education throughout life, the schools should lay the foundation for successful work. For students who will take further training in technical school or professional college, the schools should emphasize entrance requirements and preparatory skills.

THE STATEMENT DIRECTLY ABOVE TELLS US -- IN MY OPINION -- WHAT SHOULD BE

- (a) THE MOST IMPORTANT TASK OF THE SCHOOLS
- (b) AN IMPORTANT TASK, BUT NOT THE MOST IMPORTANT TASK, OF THE SCHOOLS.
- (c) A RELATIVELY UNIMPORTANT TASK OF THE SCHOOLS.
- (d) A TASK THAT THE SCHOOLS SHOULD NOT UNDERTAKE.

After you have circled one letter under each box above please answer three more questions:

HOW ARE THESE THREE PURPOSES NOW BEING EMPHASIZED IN YOUR SCHOOL(S)?

the HUMAN purpose: ___only a little ___quite a bit ___more than the other 2 ___far more than the other 2
the KNOWLEDGE purpose: ___only a little ___quite a bit ___more than the other 2 ___far more than the other 2
the CAREER purpose: ___only a little ___quite a bit ___more than the other 2 ___far more than the other 2

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